PAPER TRADE JOURNAL

THE INTERNATIONAL WEEKLY OF THE PAPER AND PULP INDUSTRY AND THE PIONEER PUBLICATION IN ITS FIELD

Established 1886

Business Currents

"The winds and waves are always in favor of the ablest navigators."

GIBBON.

More than fifty years of experience has meant development of the ability to navigate the changing currents of the interests of the pulp and paper industry.
business and the building of an organization devoted to

GOTTESMAN & COMPANY
—INCORPORATED—

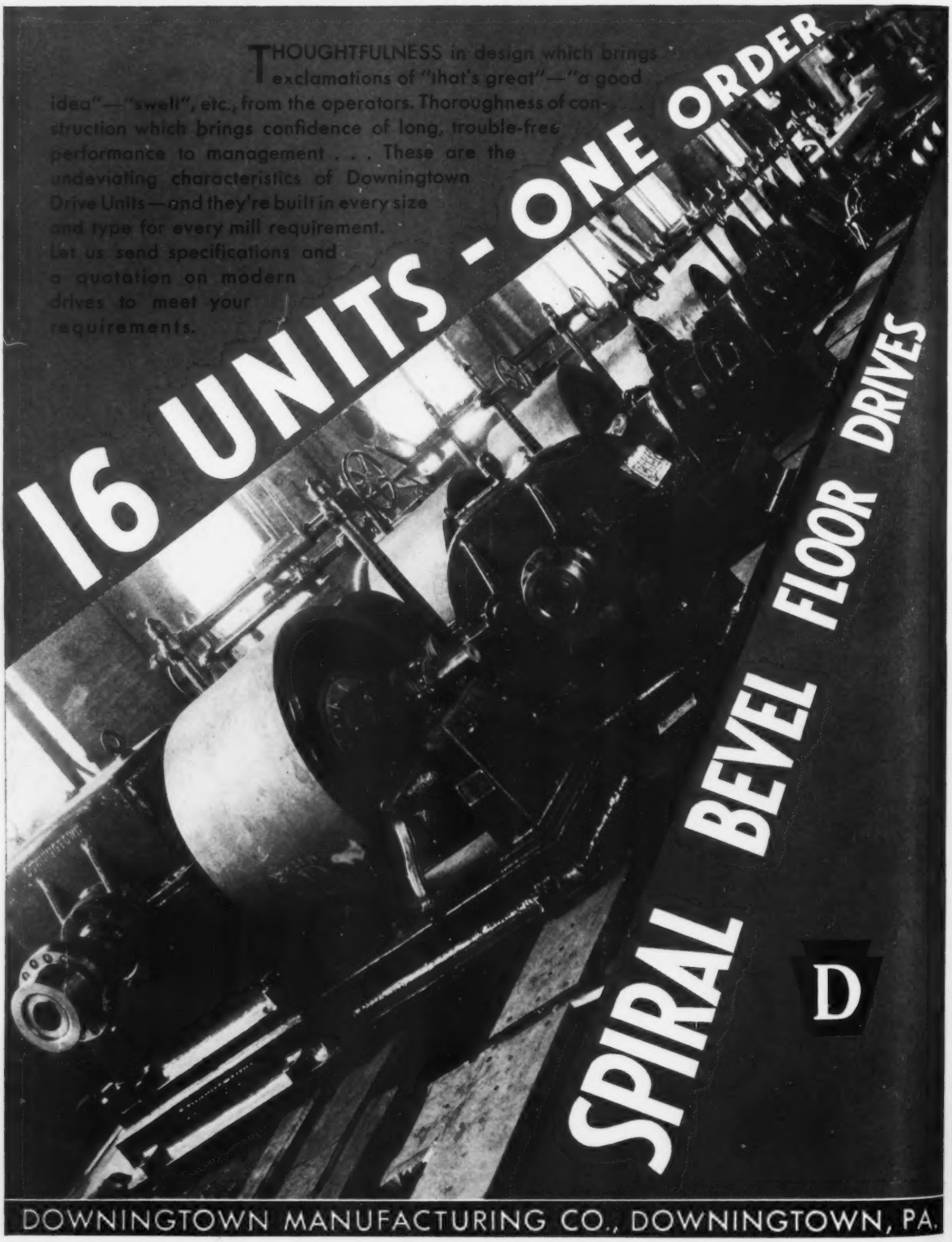
WOOD PULP

22 EAST 40th STREET NEW YORK, N. Y.
EUROPEAN OFFICES: Birger Jarlsgatan 8, Stockholm, Sweden

OCT. 28 1937
Vol. CV
No. 18

TAPPI FALL CONVENTION

DOWNINGTOWN


THOUGHTFULNESS in design which brings exclamations of "that's great"—"a good idea"—"swell", etc., from the operators. Thoroughness of construction which brings confidence of long, trouble-free performance to management . . . These are the undeviating characteristics of Downingtown Drive Units—and they're built in every size and type for every mill requirement. Let us send specifications and a quotation on modern drives to meet your requirements.
16 UNITS - ONE ORDER
SPIRAL BEVEL FLOOR DRIVES
D

DOWNINGTOWN MANUFACTURING CO., DOWNINGTOWN, PA.

Entered as second class matt... Lockwood Trade Journal... Post Office at East Stroudsburg, Pa., under the Act of Congress of March 3, 1879. Published every Thursday by the N. Crystal St., East Stroudsburg, Pa. Executive and Editorial office: 15 W. 47th St., New York, N. Y. Domestic subscription U. S. and possessions, $4.00 per year.

PAPER TRADE JOURNAL

THE INTERNATIONAL WEEKLY OF THE PAPER AND PULP INDUSTRY AND THE PIONEER PUBLICATION IN ITS FIELD

Published Every Thursday by the LOCKWOOD TRADE JOURNAL CO., Inc.

Executive and Editorial Offices: 15 West 47th Street, N. Y. C.
Western Rep.—H. K. Vinton, 123 W. Madison St., Chicago, Ill.

The Contents of this Publication are Copyrighted

TABLE OF CONTENTS

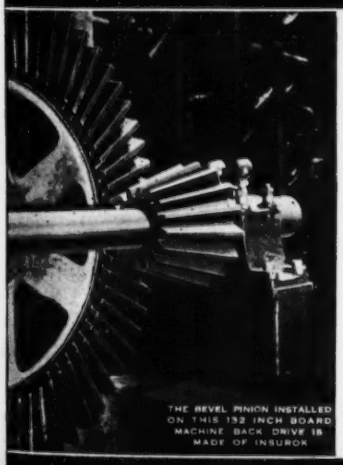
Technical Association Meets in Deep South .. 39
Firms Exhibit at Savannah 46
Those Who Attended the Convention 58
Newsprint at $50 for Second Half of 1938 64
Chicago Market Aided by Demand for Kraft 66
Financial News of Pulp and Paper Industry 71
Saturation of Absorbent Papers with Rubber Latex 74
Memorial Plaque to Robert Gair Unveiled .. 82
Construction News 86
Editorial **90**
Technical Section
The Forest Situation in the Lower South 93
Relationship Between Pine for Saw-Timber, Pulpwood and Naval Stores 103
Wood Pulp Supply of the World 107
Reburning Lime by the Nichols Herreshoff Furnace 113
Effect of the Viscosity of the Grinding Medium in the Mechanical Pulping Process 116
Pulp Bleaching Under Ultra Violet Light .. 118
Chemical Balance for a Continuous Recausticizing System 120
Wood for the Southern Pulp Mills 122
Southern Clays for Paper Making 124
High Density Vacuum Bleaching of Kraft Pulp 126
Rapid Methods for the Determination of Holocellulose and Cross and Bevan Cellulose in Wood 128
Cost of Pulpwood at Southern Mills—Cost of Growing Pulpwood 130
History of Pulp and Paper in the South .. 133
Review of Paper Industry Literature 134
Instrumentation Studies. XX 135
Imports of Paper and Paper Stock 144
New York Market Review **148**
Miscellaneous Markets **150**
Market Quotations **152**

The PAPER TRADE JOURNAL is indexed in Industrial Arts Index

Want and For Sale Advertisements Pages 166-167-168

Copyright, 1937, by the Lockwood Trade Journal Co., Inc.

A Message to
Paper Mill Technicians and Production Executives



TO cut production costs sharply and improve performance in every department, progressive paper mill production executives and technicians turn to INSUROK, the superior phenolic plastic.

Among the numerous applications in the paper mill to which INSUROK has been adapted are: Gears . . . Bearings (Oilless) . . . Toe Blocks . . . Doctor Blades . . . Suction-Box Covers . . . Cutting and Creasing Dies . . . Felt Whipper Bars . . . Valve Discs . . . Shake Springs . . . Felt Conditioner Plates . . . Save-All Pans . . . Sluice Boards for Cylinder Machines.

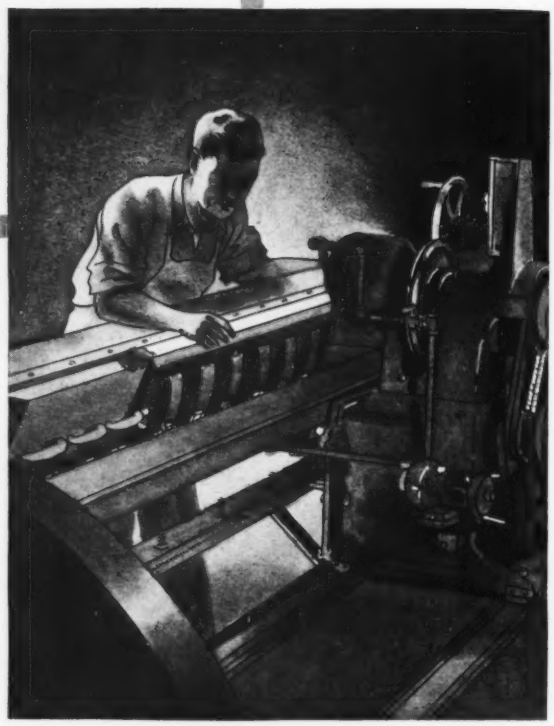
RICHARDSON TECHNICAL SERVICE

Design, Engineering and Research Divisions are available without cost or obligation. Richardson is ideally equipped to render outstanding service to paper mills. Write for detailed information.

The RICHARDSON COMPANY

Melrose Park, (Chicago) Ill. Founded 1858 Lockland, (Cincinnati) Ohio
New Brunswick, N. J. Indianapolis, Ind.
FORMERLY, THE RICHARDSON PAPER COMPANY
Detroit Office: 4-252 G. M. Building, Phone Madison 9386
New York Office: 75 West Street, Phone Whitehall 4-4487

GRIND YOUR CUTTING KNIVES *with* SEYBOLD *Precision Accuracy*

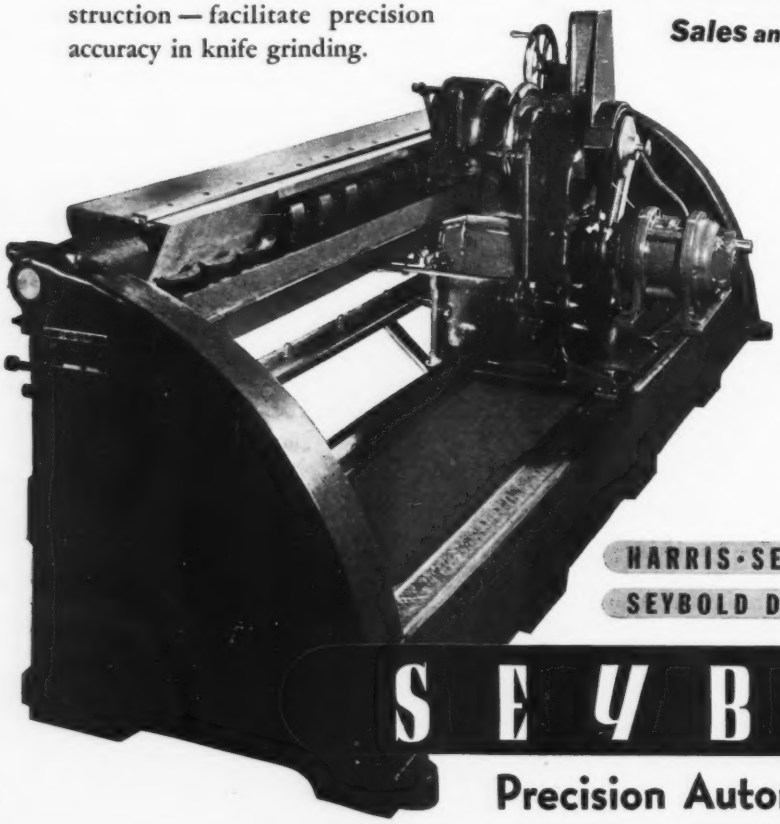


• To cut accurately, any cutting knife must be ground accurately.

Seybold Precision means that all cutting knives must be ground absolutely true, so that in placing in the cutting machine the cutting edge must be even and level with cutting stick. Knives ground unevenly or with incorrect bevel are not conducive to good cutting.

This is true also of knives that have been burnt, or on which the temper has been withdrawn in grinding.

Seybold Precision Knife Grinding Machines —because of design and heavy construction — facilitate precision accuracy in knife grinding.



Sales and Service Departments:

- New York: E. P. Lawson Co., Inc. 426-438 W. 33rd Street
- Chicago: Chas. N. Stevens Co., Inc. 110-116 W Harrison Street
- Atlanta: J. H. Schroeter & Bro., Inc.
- San Francisco, Los Angeles, Seattle: Harry W. Brintnall Co.
- Dayton· Seybold Factory
- Toronto: Harris-Seybold-Potter (Canada) Limited
- London, England: Smyth-Horne, Ltd.
- Latin America and West Indies: National Paper & Type Company

HARRIS·SEYBOLD·POTTER COMPANY

SEYBOLD DIVISION • DAYTON, OHIO

SEYBOLD

Precision Automatic Knife Grinder

PAPER TRADE JOURNAL

Reg. U. S. Pat. Off.

SIXTY-SIXTH YEAR

PAPER

Established Feb. 17, 1899
Consolidated Nov. 16, 1899
with PAPER TRADE JOURNAL.

Vol. CV, No. 18 Thursday, October 28, 1937

Established Sept. 21, 1919
Consolidated Feb. 19, 1925
with PAPER TRADE JOURNAL.

Technical Association Meets In Deep South

Fall Convention At Savannah, Ga., October 18-21, Is Attended By 800, Making It Most Largely Attended Meeting In History of the Association — Technical Men See and Hear What Is Happening In the South.

[FROM OUR REGULAR CORRESPONDENT]

SAVANNAH, Ga., October 25, 1937—Savannah's housewarming for TAPPI was early adopted by the fall convention committee as its official slogan and in every respect the meeting last week shaped up to this aim. Much interest prevailed not only in the paper industry but in the minds of the public, at large, concerning the tremendous expansion of the pulp and paper industry in the South. It was therefore quite fitting that the Technical Association of the Pulp and Paper Industry should be the first to provide an opportunity for the men of the industry to see and learn at first-hand, just what is going on and to interpret it in a way that would clarify the picture which had become somewhat blurred by the great amount of confusing publicity that has been literally thrown at the industry and the public.

So great was the interest developed by TAPPI that its convention on October 18-21, 1937 was attended by 800, the largest number of individuals that ever were present at a fall meeting of the association. The more than eight hundred present severely taxed the housing facilities of the city and made it necessary to accept the hospitality of the many citizens of Savannah who kindly opened their homes to accommodate the overflow from the hotels.

Energetic Local Committee

It is doubtful if the local committee had any idea of the magnitude of its job when it first was organized. Needless to say, however, it met the record needs of the association in a manner that reflected distinct credit on its general chairman, D. G. Moon, chief engineer of the Union Bag and Paper Company, and his loyal subcommittee chairmen. Because of the unusual burden falling on their shoulders, particular credit is due Charles Carpenter, chief chemist of the Pulp and Paper Laboratory of Savannah who handled the publicity and printing details; W. F. Allen who attended to the overwhelming job of housing those who attended and also attended to the arrangements details, a real job in itself; H. Bradley Johnson of Union Bag who took care of the registration with his usual splendid efficiency, and G. T. Wegner also of Union Bag who handled the accounts. Good old Ed Mayo and John Gamble were genial hosts to the visitors to the great Union Bag and Paper Company mill. Ed Cassel of the Chamber of Commerce was on hand to do the many necessary detail jobs for which no one ever receives due credit. J. K. Copps of Union Bag saw that the TAPPISTS got to their destinations and back again, without losing a person. O. W. A. Rodowski guided the technical program to the high standard which attracted so many to the meeting. Mrs. D. G. Moon, A. G. Ready, and P. F. McMahon arranged the women's program and social part of the program, and well earned is the great praise that they received from everyone. Like most secretaries Miss Rita Wood of Union Bag kept everything moving smoothly and was indefatigible in her enthusiastic efforts to make the Savannah meeting the tops to date for TAPPI .

The Spirit of the Deep South

To hold a convention in the deep South was a unique experience for the Technical Association. To do such a thing without meeting face to face with the time-honored Southern hospitality of the old families of a great city like Savannah, was impossible. The visit of many members to the old Southern homes, the sightseeing in a city with such an enviable history was impressive. Organized as a special committee of local citizens to see that TAPPI enjoyed the best that the South could offer, the people of Savannah under the leadership of Judge and Mrs. Gordon Saussy left nothing undone to guarantee the success of the convention. No comments could be complete that did not include mention of Col. E. George Butler, vice chairman of the Industrial Committee of Savannah, who first extended TAPPI its invitation to meet at Savannah, and also Dr. Charles H. Herty, the grand old man of the new old South, who is an institution in himself, and has become a symbol of the comeback of Southern prosperity. To Alexander Calder, president of Union Bag and Paper Company and to Jim Allen, vice-president, goes the appreciation of TAPPI for their willingness to allow paper men, including direct competitors to visit their mill and to permit so many of their fine Savannah organization to devote so much time and energy to making the convention the outstanding success it was.

The Wood Supply Problem

Since the papers presented at the meeting will be

published in full, in the PAPER TRADE JOURNAL, they will be mentioned herein only by title and author.

The Monday morning program was devoted to a consideration of the woodlands situation in the South, as this is one of the most important subjects relating to the economic status of the new industry. Charles W. Boyce, executive secretary of the American Paper and Pulp Association, presided as chairman of this session.

I. F. Eldridge, director of the Southern Forest Experiment Station at New Orleans discussed "The Wood Situation in the Lower South." This station of the Forest Service has been making an intensive survey of the available wood supply. A. E. Wackerman, formerly Forester of the Southern Pine Association, New Orleans, and now Forester for the Seaboard Air Line Railroad presented "The Relationship Between Pine for Pulpwood, Saw Timber and Naval Stores." Mr. Wackerman, as well as the others speakers stressed the necessity of intelligent forest management and conservation to assure an adequate and perpetual supply of wood for the various industries that depend on wood for their existence.

W. L. Hall, Consulting Forester of Hot Springs, Ark., showed some good figures on "The Cost of Pulpwood at Southern Mills and the Cost of Growing Pulpwood." Karl Swenning, Forester for the Mead Corporation, Kingsport, Tenn., discussed "Wood for Southern Pulp Mills" and indicated the steps being taken by the mills to perpetuate that supply. John Traquair, Director of Research, of the Mead Corporation, Chillicothe, Ohio, presented a resume of "The Wood Supply of the World."

Monday Luncheon and Woods Trip

G. N. Collins, president of TAPPI presided as toastmaster at the Monday luncheon. The guest speaker was T. Guy Woolford, president of the Georgia Forestry Association, who talked on "Forestry Problems in the South."

Following the luncheon the members were taken

D. G. MOON
Chairman General Committee.

DR. CHARLES H. HERTY
Director of the Pulp and Paper Laboratory.

to Palmetto Bluff, S. C., where an inspection trip was provided to see how the pine trees were cut and prepared for the pulp mill. Various turpentining and rosin preparing operations were shown. A boat trip was enjoyed by those who did not take the woods trip and many devoted the afternoon to participation in the annual golf tournament at the Savannah Golf Club. A feature of these links was the presence of the redoubts during the War between the States.

Banquet Program

A delightful banquet was held on Monday evening during which Judge Gordon Saussey presided as toastmaster. Addresses were made by Robert M. Fitch, mayor of Savannah, J. H. Allen, vice-president of the Union Bag and Paper Corporation who represented Alexander Calder, president, who was unable to be present, Charles W. Herty, director of the Savannah Pulp and Paper Laboratory, and Grellet N. Collins, president of TAPPI. Entertainment consisting of the singing of negro spirituals by local negro school students was enjoyed by those present. Moving pictures showing southern sports were shown on the terrace surrounding the swimming pool. This was followed by dancing.

Pulp Mill Operations Program

The technical program for Tuesday, October 19 was devoted to mill operating problems and was presided over by O. W. A. Rodowski, chief chemist of the Union Bag and Paper Company of Savannah. John Campbell, research director of the International Paper Company, Glens Falls, N. Y. and L. O. Rolleston, chief chemist of the Southern Kraft Corporation mill at Moss Point, Miss. reported the details of their new patented process for "High Density Vacuum Bleaching of Kraft Pulp." Four papers were presented by the Forest Products Laboratory, Madison, Wis., represented by M. W. Bray and E. R. Schafer. Their titles were "The Effect of Viscosity on the Grinding Medium in the Mechanical Pulping Process"; "Grinding of Loblolly Pine: Relation of Wood Properties and Grinding Conditions"; "Sulphate Pulping of Yellow Pines", "Sulphate Pulping of Longleaf Pine."

C. L. Knowles of the Dorr Company, New York, and O. W. A. Rodowski of the Union Bag and Paper Company, Savannah, presented the results of their

FOR THE TECHNICAL ADVANCEMENT OF THE PULP AND PAPER INDUSTRY

TRUST the newest BIRD SCREEN to make cleaner paper and more of it per day at lower cost per ton.

APPLY the BIRD TRIPLE-TREATMENT CENTRIFINER for super-efficient removal of both light and heavy dirt.

PUT the BIRD SAVE-ALL to work on your waste water to earn the highest net return per pound of fibre recovered.

PRODUCE more paper per machine by eliminating shut-downs for felt wash-ups with the VICKERY FELT CONDITIONER.

INSTALL VICKERY DOCTORS on every press roll, breast roll, wire roll, dryer, calender and super-calender roll.

YOU CAN MAKE MORE MONEY
WITH NEW BIRD MACHINERY

BIRD MACHINE COMPANY
SOUTH WALPOLE · MASSACHUSETTS

joint investigation of "The Chemical Balance for a Continuous Causticizing System." H. A. Morrison of Oliver-United Filters, New York, discussed "Vacuum Washers vs. Diffusers," a subject of considerable current interest. W. Hirschkind, D. G. Pye and E. G. Thompson of the Great Western Electrochemical Company, Pittsburgh, Calif., presented (by title) a paper on "Pulp Bleaching Under Ultra-Violet Light." K. A. Forrest, manager of the Crossett Paper Company, Crossett, Ark, outlined (by title) his experiences in "Reburning Lime in the Herreshoff Furnace."

Tuesday Luncheon and Mill Visits

R. G. Macdonald, secretary-treasurer of TAPPI presided as toastmaster at the Tuesday luncheon. J. H. Allen, vice-president of the Union Bag and Paper Corporation was the guest speaker and presented a "History of the Pulp and Paper Industry in the South." The chairmen of the various convention subcommittees were introduced by D. G. Moon, general chairman.

Following the luncheon visits were made to the new mill of the Union Bag and Paper Corporation and to the Savannah Pulp and Paper Laboratory.

The Crinoline Party

From the social standpoint the high light of the meeting was the costume dinner and dance, during which a few hundred of those present appeared in costume depicting the old South. Prizes were given for the best costumes. The decorations included a genuine negro cabin, pine trees and Spanish moss. Entertainment consisted of songs and dances by negro entertainers and a spectacular mock battle between a fort and a battleship in the De Soto pool.

Fiber Structure and Fundamental Research

Conforming to the trend in TAPPI meeting programs a number of papers were presented dealing with the fundamental concepts regarding the nature of the fibers in plants, including trees, and in pulp. An entire session of this meeting was devoted to a group of papers of this type. It has been felt that only by such fundamental studies can the facts regarding pulping be learned and real progress made in the improvement of pulp and paper making.

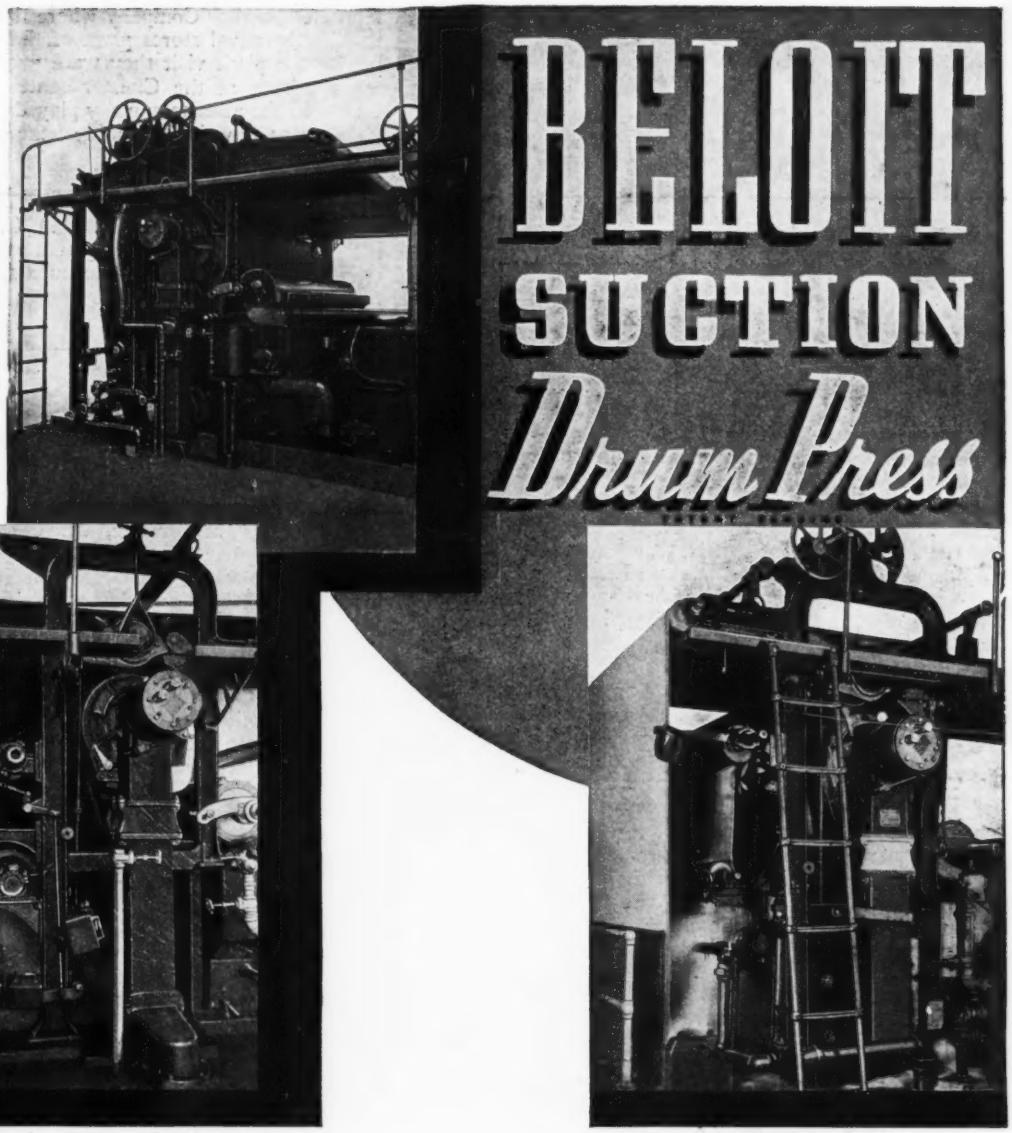
R. G. MACDONALD
Secretary, Technical Association.

Charles Carpenter, chief chemist of the Pulp and Paper Laboratory of the Industrial Committee of Savannah presided as meeting chairman. The staff of the Institute of Paper Chemistry, Appleton, Wis., presented "A Further Report of Changes Taking Place in the Structure of Fibers as a Result of the Operations of Pulping and Stock Preparation." This presentation was illustrated by some excellent high speed photographs of fibers in suspension in a liquid. G. J. Ritter of the Forest Products Laboratory, Madison, Wis. and W. O. Van Beckum, TAPPI fellow at the University of Wisconsin, presented their final report covering "Rapid Methods for the Determination of Holocellulose and Cross and Bevan Cellulose in Wood."

Thomas Kerr of the Bureau of Plant Industry, U. S. D. A. discussed "The Visible Structure of

G. N. COLLINS
President, Technical Association.

W. R. MAULL
Vice President, Technical Association.



Results: Equivalent to suction drum and suction primary press combined

An absolute necessity on every board machine

Superior to all other methods of water removal on wet felts. • There must be a reason for over thirty of these rolls.

Ask the mills who installed them.

THE BELOIT WAY BELOIT IRON WORKS PAPER MACH'Y BELOIT WIS **IS THE MODERN WAY**

BELOIT IRON WORKS, Beloit, Wisconsin, U. S. A.

O. W. A. RODOWSKI
Committee Chairman

CHARLES CARPENTER
Committee Chairman

Natural Fibers," illustrating his talk with some remarkable photographs. H. Ainsworth Harrison of Cooke & Nuttall, Horwich, England, reported on the progress made by the Special Committee of the Paper Makers Association of Great Britain and Ireland, and on its investigation of "The Fastness to Light of Colored Papers."

The Pulp and Paper Laboratory of Savannah presented two excellent papers. One was on "Acid Pulping of Young Southern Pines, II Sulphite Pulps for Viscose, Newsprint and Other Papers," by Charles Carpenter, and the other on "Grinding Southern Pine for Newsprint" by A. C. Fuller, plant manager of the laboratory.

Poole Maynard, consultant for the Atlanta, Birmingham and Coast Railroad, presented (by title) a paper on "Southern Clays for Papermaking."

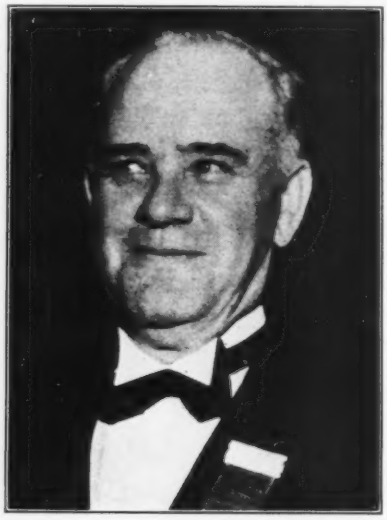
Oyster Roast and Buffet Supper

On Wednesday afternoon buses transported the members to Tybee Beach where lunch consisted of an oyster roast, Brunswick stew, etc. Boxing bouts were performed in a ring on the beach.

Following the beach program the members returned to the De Soto Hotel for an entertainment and buffet supper.

Events at Brunswick and Sea Island

About 300 members were taken to Brunswick, Ga., in a special 21-car Pullman train as guests of the Hercules Powder Company where they had a chance to visit the naval stores plant of that company. Following the plant visit they were guests of Hercules for luncheon at the Cloister Hotel on Sea Island Beach. In the afternoon many played golf, took sightseeing trips or visited the mill of the Brunswick Pulp and Paper Company.



JAMES H. ALLEN
Vice President, Union Bag & Paper Corp.

Ladies' Program

Under the direction of Mrs. D. G. Moon the 170 ladies present enjoyed a delightful program of sightseeing, bridge and golf tournaments, luncheon, and fashion show in addition to events enjoyed jointly with the men.

Stresses Proper Use of Southern Forests

The expansion in the pulp and paper industry in the South, which is underway at the present time, appears to be based upon the idea that the supply of available raw material is inexhaustible, Richard D. Stevens, assistant forester, University of Arkansas College of Agriculture, says.

"This," he states, "is merely the repetition of the history of the lumber industry in this country."

An inexhaustible supply of timber, Mr. Stevens declares, will depend on several factors—how much timber is on the ground at present, how the timber is cut and managed, the rate of growth and the demands of other industries.

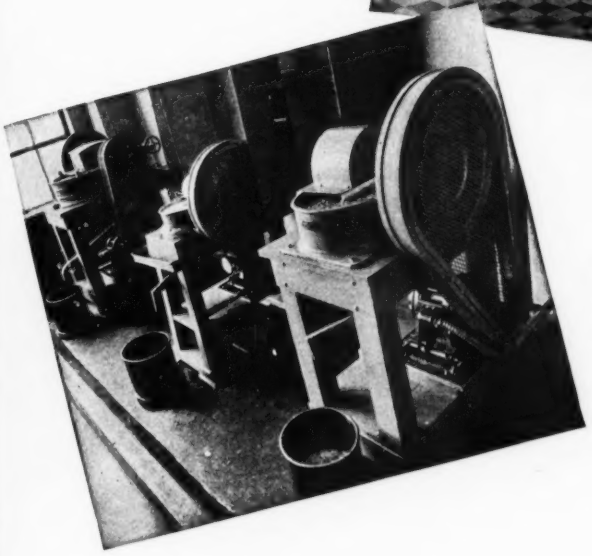
According to the most reliable information available, Mr. Stevens says that the growth and drain of raw material in the South about balance at the present time. The addition of new pulp mills may result in intense competition for wood and a resulting depletion of the supply. This situation, the forester declares, can in all probability be averted if proper steps are taken to maintain the growing forests.

"The brightest spot, but one that has yet to be proved in practice, is that forest growth in the South is far below the capacity of the land to produce wood," Mr. Stevens says. "Proper measures will probably treble the annual growth."

These proper measures will consist of absolute fire control and a cessation of clear-cutting forest stands. The forest industries, which at present are working on a liquidation basis, must reduce their size to one compatible with the forest growth of their region. Each landowner must insist that all forest land be kept in its best productive condition by leaving adequate growing stock. The public must co-operate in furnishing adequate fire protection, tax equality, and suitable forest credits.

"This picture, as seen by many, does not bear out the idea of an inexhaustible supply," Mr. Stevens says. "But," he points out, "the South can produce the timber if proper management is followed. All of the obstacles are man-made, and, therefore are within the realm of practical solution."

The forester says that three factors are bringing about the activity of this new industry in the South. These factors are cheap and plentiful raw materials, low wage scales and cheap transportation to markets. "It would appear that none of these are advantageous to the economic situation of the South," Mr. Stevens declares. Besides these factors, he says that the new mills will have the advantage over the North of up-to-date machinery, although actual processing costs may run a little higher.



•

Sections of our new Paper Laboratory adequately equipped to handle all problems pertaining to the paper trade.

•

GDC

GENERAL DYESTUFF CORPORATION

435 HUDSON STREET, NEW YORK, N. Y.

Pulp and Paper Machinery and Supply Firms Exhibit at Savannah, Ga.

Among the pulp and paper machinery manufacturers and supply concerns who made exhibits in connection with the fall meeting of the Technical Association of the Pulp and Paper Industry at Savannah, Ga., October 18-20, 1937, were the following:—

Bagley & Sewall Co.

The exhibit of The Bagley & Sewall Company, Watertown, N. Y., consisted of continuous moving pictures during the convention hours. These pictures covered "Shop Facilities and Machine Construction" and "Paper Making Machines in Operation." Several pieces of equipment were on display, the principal feature being the Simplex Shake Unit with its casing cut away and the inside of the housing sufficiently illuminated to enable the observer to view the operation of its numerous parts. This unit was driven by small electric motor and Link Belt V R D unit. Another piece of equipment was a set of vertically adjustable anti-friction bearings and horizontal adjustment mounting for table rolls. Representatives in attendance were Edward S. Lansing, G. P. Prather, Roy F. Hayes and F. M. Sanger.

Bailey Meter Co.

The Bailey Meter Company, Cleveland, Ohio, displayed six colored and framed diagrammatic drawings, each being approximately 2 x 3 feet. These drawings showed the following subjects: Bailey Metering and Control Equipment applied to a B&W-Tomlinson Black Liquor Recovery Unit. Bailey Combustion and Feedwater Control at Ontario Paper Company, Thorold, Ont. Bailey Meter Combustion Control installed on two integral furnace boilers fired with pulverizers at Kimberly-Clark Corporation, Niagara Falls, N. Y. Bailey Meter Control installed on two pulverized coal-fired boilers at S. D. Warren Company, Cumberland Mills, Maine. Bailey Meter Control installed on Combination Oil and Bark Burning Boiler at Kraft Corporation of America, Fernandina, Fla. Arrangement of Bailey Meter Control, Pressure Reducing, Desuperheating and Steam Distribution equipment in a typical Kraft mill.

Bauer Bros. Co.

Bauer Brothers Company, Springfield, Ohio, had an interesting exhibit of samples and photographs of the type of work of their Double Disc Pulpers and Refiners. These machines are constructed with two discs which run in opposite directions. They can be equipped with different plates or can be run at different speeds, at different pressures and under varied temperature conditions. The range of this piece of equipment, therefore, makes it useful from the original defibering of hard rigid materials to the treating of stock for the paper machine. Soaked wood chips, semi-chemical and semi-sulphite chips and pulp, ground wood, sulphite or kraft pulp rejects can all be defibered and the stock prepared for the wire. Some of the most interesting examples of this work were as follows: One jar containing pieces of kraft knotter rejects as large as a double finger, which was the raw material, was accompanied by another jar showing the fiber producted therefrom and this fiber seemed free from shive and particularly free from fines or ground up material. Another exhibit of the same type showed semi-chemical chips from birch that were so little cooked that they looked exactly like the raw

Picture Taken at Ladies' Tea at Wormsloe Gardens

Stowe-Woodward, Inc. appreciates the privilege—and the responsibility—of furnishing rubber covered rolls to many of the new mills now operating or soon to operate in the South. The following is a partial list of mills in which there are Stowe-Woodward Rubber Covered Roll installations:

Brunswick Pulp & Paper Company.....Brunswick, Georgia
Champion Paper & Fibre Company.....Pasadena, Texas
Chesapeake-Camp Corporation.....Franklin, Virginia
Southern Kraft Corporation.....Georgetown, South Carolina
Southern Kraft Corporation.....Spring Hill, Louisiana
Union Bag & Paper Corporation.....Savannah, Georgia
West Virginia Pulp & Paper Co...Charleston, South Carolina
Fernandina Pulp & Paper Co.....Fernandina, Florida
National Container Corporation.....Jacksonville, Florida

STOWE-WOODWARD, INC.

NEWTON UPPER FALLS • MASSACHUSETTS

NEW YORK OFFICE • WOOLWORTH BUILDING

Makers of WHITE STAR *Rubber Covered Rolls,* TANNITE *Couch Rolls*
STONITE *Top Press and Smoothing Rolls—All by the* COREWELD *Process*

chips. Its accompanying sample showed the fiber that was obtained from these chips by passing through the Bauer Refiner, and this pulp looked smooth and fibrous almost like chemically cooked pulp. The samples of stock treating done by the Double Disc Machine were shown in sets of two to four, and showed different degrees of refining with different settings of the plates. Among these latter were exhibited fibers that had been taken from the pulp mill decker, refined exclusively in a Bauer Double Disc Refiner giving test sheets running as high as 130 per cent Mullen. Another interesting feature of this exhibit was a photographic enlargement of the machine that showed very clearly the relation of the working parts and gave a splendid conception of the rugged construction. These units can be powered high enough to give exceptionally large tonnage capacity per day per machine. The literature displayed consisted of a folder describing the machine in general and showing some interesting applications of this machine in large pulp and paper mills throughout the country; a reprint of some of the articles and speeches delivered by their Mr. Cosler on the application of this machine in the various branches; and a booklet which covers in a general way the utility of the machine in the paper industry and contains sheets made from fibers produced by the Bauer Double Disc Pulper in the processes described.

Beloit Iron Works

The Beloit Iron Works, Beloit, Wis., showed pictures illustrating some of the more noteworthy Beloit equipment, but used its space more especially as a meeting place for TAPPI members.

Brown Instrument Co.

The Brown Instrument Company (an affiliate of Minneapolis-Honeywell Regulator Company) stepped aside from the regular instrument display to one of rather unique design in order to show the most in its limited space. A modernistic design, black wings trimmed with silver, with a set-back and flood-lighted background consisting of a 4 foot by 5 foot enlargement of a cylinder board machine photograph constituted the "backbone" of the display. Smaller photographs in silver frames, mounted against the background and on the side wings, illustrated "Brown in the Paper Industry" in actual applications of instruments. Silver-trimmed thermostats and other devices provided Minneapolis-Honeywell atmosphere. Green drape and side trim added richness and color. A few floor stands with cut-away flow meters introduced a bit of the actual mechanical.

Cameron Machine Co.

The Cameron Machine Company, 61 Poplar street, Brooklyn, N. Y., had a collection of rolls produced on their machines, also pictures of actual installations on display. C. C. Van Stry and J. Scheuerman attended the convention to represent the company.

Crane Co.

The Crane Company, Chicago, at its exhibit showed an 8 inch stock valve on pedestal, a 4 inch ring joint cut out sample, a 6 inch No. 1463-18-8 trim gate valve on pedestal and a 1 inch 484½ gate valve. In addition to the pump stock valve itself, which was the feature of the exhibit, its operation was shown by a cutaway photograph some six feet high.

Dorr Co.

The Dorr Company's exhibit centered around a large flowsheet, printed on kraft board, showing the arrangement of one of the Dorr Continuous Recausticizing Systems at the kraft mill of the Union Bag and Paper Company in Savannah. The various equipment units constituting unit processes in the system were displayed in diagrammatic form, and connecting flow lines showed path of raw green liquor, new lime and reburned lime throughout the system until they emerged as strong liquor ready for the digesters and

PICTURE TAKEN AT THE ANNUAL MEETING OF THE TECHNICAL ASSOCIATION OF

waste products from which the greater part of the soda had been removed. At different points in the system, there were displayed small bottles on shelves, each bottle containing an actual sample of the material in circulation at that particular point in the process. On one side of the large flowsheet there appeared a list of a dozen or more southern kraft mills, having an aggregate capacity of over 3500 tons per day, which are using the Dorr Continuous Recausticizing System. On the other side, there appeared a list of the steps in the Dorr System, arranged in sequence. Dr. C. L. Knowles, of the Dorr Company, and O. W. Rodowski, of Union Bag and Paper Company, presented a joint paper at the meeting, entitled "Chemical Balance in a Continuous Recausticising System," based on operations at this plant. Preprints of this paper, including flow diagrams and chemical balance sheets, were made available for distribution at the Dorr exhibit.

Downingtown Mfg. Co.

The Downingtown Manufacturing Company, Downingtown, Pa., had a motion picture exhibit at its booth showing the new kraft machine of the West Virginia Pulp and Paper Company at Charleston, S. C., this machine being equipped with Downingtown suction rolls. There were also pictures of the board machine at the Covington plant of the West Virginia Pulp and Paper Company showing the extractor and suction first press; also a rubber covered suction press on a Fourdrinier book machine at the Covington plant. There were pictures of the vat and press part showing the extractors and suction felt rolls on the Manchester Board and Paper Company machine at Richmond, Va. and various other movies showing Fourdrinier and board machines equipped with suction rolls and Duo-dehydration press parts. The exhibit was in charge of G. C. Walton. It was well attended and created considerable interest among mill operators because they could see the machines in operation. The Downingtown Manufacturing Company was represented by the following members: Mr. Jacob Edge and daughter Elizabeth, Mr. and Mrs. Enright A. Ellis, Mr. and Mrs. Oscar C. Cordes, Mr. and Mrs. G. Clifton Walton.

General Electric Co.

Splashproof motors, gear motors, and magnetic switches were featured in General Electric's exhibit. A novel angle of the exhibit was supplied by enlarged photographs of G-E equipment installed at the Savannah plant of the Union Bag & Paper Company. These pictures formed a background for the G-E booth. During their visit to the Union Bag and Paper Company's plant, TAPPI men saw in actual operation such G-E equipment as double-extraction turbines, cubicle switchgear, high-voltage cubicle control, modern electric sectional drive with Selsyn control, and regenerative braking winder drive with constant-tension control. General Electric representatives at the meeting included W. W. Cronkhite, H. W. Rogers, E. D. McKellar, R. H. Jackson, A. J. Kroog, J. H Persons and L. F. Rodewig.

Otto J. Goeppinger Engineer

This exhibit featured the Warren Stock Pumps, DeZurik Easy Opening valves and showers and Sturtevant Balepulper and Controls. Note the Warren exhibit consisted of a 4 inch single stage centrifugal stock pump for machine chest service. It was claimed for this pump that the rate of discharge is practically constant regardless of the level of the stuff in the stock chest. A number of these pumps have been placed in operation, replacing plunger pumps. A large chart was displayed showing how nearly constant the level has been maintained in the stuff box, over a long period of time, with one of these pumps. DeZurik Easy Opening Valves straight-way and three-way type, a full size shower pipe with cut-away lump strainer as well as DeZurik Mendham Cleanable Trim Squirts were shown in the exhibit of the DeZurik Shower Company. Owing to the large size of

THE PULP AND PAPER INDUSTRY, SAVANNAH, GA., OCTOBER 18-21, 1937.

the Sturtevant Balepulper it was only possible to exhibit enlarged photos of the machine and its operation. A vacuum control valve for suction boxes and weight control were also exhibited by the Sturtevant Mill Company. The exhibit was in charge of Otto J. Goeppinger, special paper mill engineer.

Goulds Pumps, Inc.

Goulds Pumps, Inc., Seneca Falls, N. Y., had a very representative display. With the four types of pumps shown almost every pumping requirement in the paper industry can be met. The Fig. 3105, 4 inch size, is a quality product sold for efficiently handling stocks up to 6 per cent. This pump has a top horizontal discharge which eliminates air binding in the casing. The 45 deg. angle of the casing parting and the design of the suction connection make it possible to remove the entire rotating element without disturbing the suction or discharge line. The Fig. 3158, 2 inch size, is a general service pump of lighter construction and is built in sizes up to 4 inches. It lends itself readily to the handling of corrosives because the wearable parts are minimized, and the cost of special metals or replacements is correspondingly small. With a special 2 vane, side suction, non-clogging impeller, this pump can handle stocks up to 5 per cent consistency. A third pump exhibited, Fig. 3605, 2S size, is built for 24 hour service handling alkalies where corrosion and abrasion must be resisted, as in the case of black or green liquors. The construction of this pump lends itself readily to the use of special alloys and to quick replacements of parts in contact with the liquid. The fourth pump shown was a Goulds "Close-Cupld", 2H size. This is Goulds answer to the growing demand for a highly efficient, compact and sturdy centrifugal pump for handling low viscosity liquids. This pump embodies all the fine features of centrifugal construction, such as deep stuffing box fitted for water seal or flush-out, top horizontal discharge and easily replacable wearing parts. The fifth exhibit was Gould's new "Stockline" Diaphragm Gauge Connection to be used for measuring pressures in stock lines. It consists of two recessed circular flanges with a rubber diaphragm attached between them. One chamber receives stock, and the other to which the gauge is attached is filled with water and sealed. The stock runs through a 3 inch connecting pipe up to the diaphragm. The pressure is transmitted through the diaphragm and water, and actuates the gauge to give exact pressure reading. This connection arrangement prevents clogging of gauge with precipitated stock and has been proven very successful in tests.

A. P. Green Fire Brick Co.

The A. P. Green Fire Brick Company conducted a small display at the TAPPI Convention. On display were A. P. Green's famous Empire stiff mud brick and the comparatively new but very rugged brick, the KX-99. These two brick have been used by paper makers with splendid success in soda recovery furnaces. A. P. Green's "Aristocrat of Fire Brick," the Mizzou, and its brother, the Kruzite, were displayed as kiln liners for rotary lime kilns in the paper industry. These brick are both made of Missouri's unique Diaspore clay, which has a high degree of alumina content and is exceptionally heat-resisting. The G-25 and G-22 Insulating Fire Brick, whose constantly increasing number of uses have found them a place in the paper industry, were also shown. These are made from first-quality Missouri fire clay by an exclusive patented process. G-25 has the lowest thermal conductivity of any brick in the field. As material for boilers, A. P. Green's famous Quik-Pach and 'Sairset were exhibited and Mexi-komo was displayed as an excellent cement for use in soda recovery furnaces. George Ford, of New York City, vice-president of the A. P. Green Fire Brick Company, was in charge of the booth and was assisted by J. Clanton Ellis of Atlanta, district sales manager, and by John D. Robinson, Savannah refractories dealer.

Gruendler Crusher & Pulverizer Co.

The Gruendler Crusher and Pulverizer Company, 2915-17 North Market Street, St. Louis, Mo. at its exhibit specialized on its new pulp refiner.

This new Gruendler Turbo Pulp Refiner on which patents have been applied for is of the centrifugal type and through exhaustive tests under continuous operation has proven that little or no disintegration of fibres is had, but higher Mullen with high tear and high freeness with maximum formation has been had with considerable reduction in power. It can be applied on Kraft stock, knots, old waste paper, straw, semi-chemical, as well as semi-sulphite pulps, all as used in the pulp and paper industry. Full information will be given by representatives of the Gruendler Crusher and Pulverizer Company of St. Louis, and the Freyn Engineering Company of Chicago.

The Gruendler Crusher and Pulverizer Company are also manufacturers of bark and butt end shredders, rechippers, salt cake grinders, straw shredders and complete coal handling equipment.

Gulf Oil Corp.

The Gulf Oil Corporation planned its exhibit so that one might see the story of Gulf lubrication in the paper industry. The pictures illustrating specialized lubrication in typical paper mills lit up consecutively following the process from the pulp to the finished product. By an ingenious method of synchronizing flashing captions for these pictures with the illumination of the pictures themselves, the story was made easily comprehendable at a glance. The Gulf representatives in attendance at the booth were A. L. Buntin, assistant division sales manager at Atlanta, L. J. Daughtridge, R. G. Peeples and E. C. Glenn, Jr.

Hercules Powder Co.

The PMC Exhibit at the Hotel DeSoto mainly was devoted to the details involved in handling the Hercules-PMC special trip to Brunswick. Attendants were on hand to take care of reservations, baggage, Cloister golf information, and scheduling the side trips for those who were on the journey. A full line of paper making chemicals was exhibited at the PMC booth and these, along with colored motion pictures describing the manufacture of naval stores products, received considerable attention from the visiting TAPPI members.

Ingersoll-Rand Co.

Ingersoll-Rand Company exhibited a full-sized paper stock pump in its booth. This pump was sectioned in various places to show its construction. In addition, the company had a supply of literature

EBG GETS A CLEAN BILL OF HEALTH... VALVES GIVEN FINAL INSPECTION. *Besides being thoroughly cleaned and inspected when returned to the plant, all valves are given another final test before the container is shipped out. We insist upon perfect performance. It is the last step in a rigidly maintained system of cleaning, scouring, steaming and reconditioning that all EBG cylinders are submitted to before they get a clean bill of health. Such Dutch housewife thoroughness is your guarantee of efficient results when you use EBG Liquid Chlorine.*

•

ELECTRO BLEACHING GAS COMPANY
Main Office: 60 East 42nd Street, New York, N. Y.
Plant: Niagara Falls, N. Y.

EBG Liquid Chlorine
FIRST IN THE COUNTRY

covering its complete line of equipment for the pulp and paper mill industry. Representatives from the Birmingham sales branch and from the New York headquarters office were in attendance during the show.

International Nickel Co., Inc.

The International Nickel Company, Inc., 67 Wall street, New York, N. Y. occupied Booth No. 8. The International Nickel Company's display brought to the convention some of the outstanding new developments in the use of Monel on paper mill equipment. Prominent among these are Monel covered steel tube rolls which were installed on several of the wide high-speed fourdrinier machines in new Southern craft mills. Monel perforated plates for pulp screens and Monel perforated plates for top screens of diffuser drainage bottoms will be on display. The exhibit featured Monel paper machine equipment such as save-all trays, suction box tops, and dandy rolls. Monel jordan fillings, doctor blades, evaporator tubes, shower pipe, and accessories also were on display. New literature on Monel in the paper industry, Monel wire cloth, and Monel covered rolls was distributed to visitors. Attendants at the booth were J. F. Nation of the J. M. Tull Metal and Supply Company, Inc.,southeastern distributors, and F. L. LaQue, E. A. Turner, and T. E. Lagerstrom of the International Nickel Company, Inc., New York.

Jeffrey Mfg. Co.

The Jeffrey Manufacturing Company, Columbus, Ohio had an interesting exhibit in Space No. 1. On display were several sections of chain used in the various phases of material handling in the pulp and paper industry; a Reliance and Hercules type belt idler; and Jeffrey-Taylor electric vibrating feeders. L. W. Meadow of the Jeffrey branch office in Birmingham, Ala., was in charge of the Jeffrey booth. From the home office in Columbus came C. R. Heller, vice president in charge of conveyor sales and L. E. Brill, manager Product Sales Division. The Jeffrey Manufacturing Company manufactures a complete line of material handling equipment and shredders for the plup and paper field.

Johns-Manville

Using as its headline, "Johns-Manville Service to The Paper Industry," J-M carried out this theme in a display which featured numerous products used by the pulp and paper industry in many different ways. Transite Asbestos-Cement Pipe that offers new economies in water transportation was exhibited. Relatively light, this pipe is quickly and economically installed. Because it is physically impossible for Transite Pipe to tuberculate, and it is inherently resistant to soil corrosion, Transite is said to be virtually free from maintenance expense throughout its long years of service. J-M Transite is also employed in the construction of paper machine hoods used extensively throughout the industry. J-M insulated Rotproof Roofs were also represented at the exhibit. Permanently waterproof and rotproof, these Johns-Manville Roofs solve condensation problems and are ideal for beater and machine rooms. Other features of the display were the complete lines of packings, gaskets, friction materials, insulations and refractory cements wihich John-Manville has designed to meet any service on all types of pulp and paper equipment. Products of special interest to the paper industry were "Eel-Slip," a new J-M bearing material slippering as its name implies, which is used for suction box covers, doctor blades, etc.; and J-M Celite, No. 263, which controls pitch trouble.

Lukenweld, Inc.

Lukenweld. Inc., of Coatesville, Pa., exhibited a model of the Lukenweld Steel Drier for paper machines, which this concern is now introducing to the paper industry following several years of development and service of such driers in paper mills.. The Lukenweld Steel Drier is said to be the first perfected steel drier, providing controlled steam distribution, developed for the paper industry. Its material of construction is a specially developed rolled steel which is the product of years of experimentation to produce a sound, flawless and close-grained steel suitable for paper machine driers, without the inherent disadvantages of cast iron. The Lukenweld Steel Drier is built by welding, utilizing the most modern welding technique and thoroughly efficient stress-relieving which entirely eliminates welding stresses and warping.

For the ordinary drier, the form of the Lukenweld Steel Drier is essentially that of the conventional cast iron drier. However, the shell is of special, close-grained steel for clean surface, with the heads welded to the shell. For higher pressures demanded by modern production machines, and for driers of larger diameters, the Lukenweld Steel Drier is built in double shell construction. This construction is capable of providing controlled steam distribution at pressures up to 150 lbs., and in driers up to 15 feet in diameter, with shell face size limited only by transportation facilities.

The advantages of the Lukenweld Steel Drier are said to include, controlled steam distribution, uniform drying; higher steam pressures, more production; clean surface, better finish; higher drying efficiency, less steam consumption and lighter weight. The Lukenweld Chromium-Plated Drier is available for the following applications: Yankee Driers—Available in sizes up to 15 feet in diameter, for pressures up to 150 lbs., the lustrous drying surface produces a glossy finish superior to that obtainable with any other surface; Paper Machine Driers—For cooling drums, full size chromium-plated driers are important for high speed machines; Creping Driers—Chromium-plated creping driers will produce finer crepe if desired, and reduce any tendency to scoring; Converting Driers—In the converting industry, chromium-plated driers are available in any type or size, and can be used to advantage for a number of applications.

Norma-Hoffman Bearings Corp.

Norma-Hoffman Bearings Corporation, Stamford, Conn., in its display showed representatives samples of its various types of ball, roller and thrust bearings. The company also displayed representative samples of its pillow blocks and mountings equipped with self-aligning ball and roller bearings. A feature of its display was its new Cartridge type ball bearing, a complete bearing unit embodying built-in but removable seals of special design and a grease refilling plug for relubrication of the bearing when necessary. These bearings are of the double row with a

single row of balls and have a large volume for grease insuring long life before the grease must be renewed.

Oliver United Filters Inc.

Oliver United Filters Inc., had a large booth in the lobby of the Hotel DeSoto at the TAPPI meeting in Savannah. Among the products exhibited were: the latest designed screen sections, both rubber-covered and cast-iron Oliver-Young Valves. Enlarged photographs were displayed describing the Oliver Kraft Washing System and the operating advantages of the Oliver-Young Filter, around which this system is built. Among the paper engineers in attendance were Charles Fuhrmeister, Jr.; H. A. Morrison; and Frank O. Young.

Pusey & Jones Corp.

The Pusey & Jones Corporation displayed a large striking poster entitled, "Leading the Parade In the March South," and showing a map of the Southern states. Just beneath this was a schedule of the companies in which Pusey & Jones paper making machines have been installed, including the following:— Albermarle-Chesapeake, Inc., West Point , Va.; Chesapeake-Camp Corporation, Franklin, Va.; Columbian Paper Company, Bristol, Va.; Mead Corporation, Kingsport, Tenn.; Champion Fibre and Paper Company, Canton, N. C.; Southern Novelty Company, Hartsville, S. C.; West Virginia Pulp and Paper Company, Charleston, S. C.; Union Bag and Paper Corporation, Savannah, Ga.; Southern Kraft Corporation, Moss Point, Miss.; Bogalusa Paper Company, Bogalusa, La.; Brown Paper Mill Company, Monroe, La.; Advance Bag and Paper Company, Hodge, La.; Equitable Bag and Paper Company, Orange, Tex.; and National Container Corporation, Jacksonville, Fla. It was stated that the production capacity of Pusey-Jones machines in the South is more than 1,000,000 tons per year. At the bottom of the poster in prominent type an invitation was extended to convention visitors to see Pusey and Jones paper machines 1, 2 and 3 at the Union Bag and Paper Corporation's new mill at Savannah.

Republic Flow Meters Co.

Designed primarily as a place for meeting friends and resting tired feet, the booth of Republic Flow Meters Company was attractively furnished with comfortable chairs and davenports. Charts, data sheets and photographs of the various interesting installations of Smoot automatic combustion control equipment, feedwater level and excess pressure pump controls, turbine-type valve, reducing valve and desuperheater stations and Republic instruments, as recently installed in new Southern paper mills were on display. Attractive and well-designed bulletins covering the above equipment were also available. George Hendrickson, sales manager of Republic Flow Meters Company and Thomas Bell, engineer, in charge of the Atlanta office, were in attendance at the booth.

CRINOLINE DAYS' BALL

Rettelmeyer & Co.

Rettlemeyer & Co., 434 Hurt Building, Atlanta, Ga., at their exhibit showed liquid level controllers, pressure regulators and steam traps and strainers made by the Fisher Governor Company, and copper expansion joints for high pressure and low pressure steam made by Joseph Kopperman & Sons.

Rosenblad Spiral Heat Exchanger

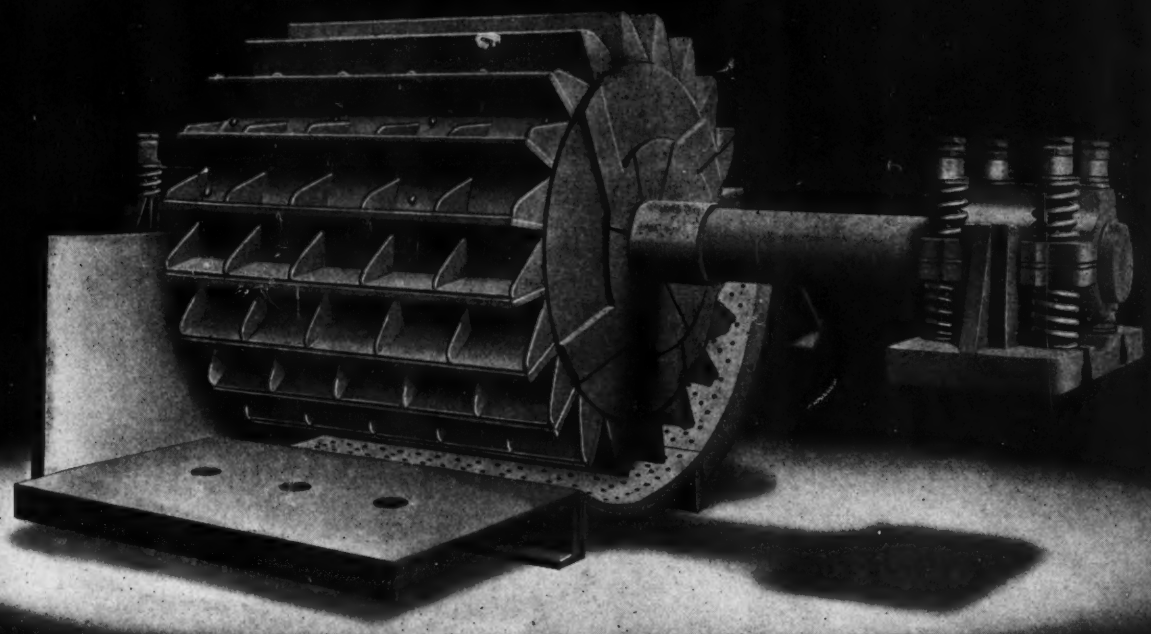
The Rosenblad Spiral Heat Exchanger was shown in booth 27. This heat exchanger is of an entirely new design, the heat interchanging surface being built up by sheet steel. Two steel plates are wound up in spirals around a center forming between them two helical channels. The apparatus shown was a condenser for low pressure vapors of cross current type. Photographs of other types for heat interchanging between two liquids and between steam under pressure and liquids were shown. The latter types have a perfect counter current. The design is extremely compact. The apparatus shown had a heating surface of 140 square feet. The Rosenblad Spiral Heat Exchanger has found widespread use in chemical industries, especially the pulp industry for recovery of heat from all kinds of waste dirty liquids and vapors. It is especially useful for reclaiming low grade liquid heat.

There are some 600 of this type of heat interchanger in use or under installation throughout the world. The first to be installed on this continent are in use at Union Bag Mill, Savannah and have now been in uninterrupted service for one year taking care of the blow-steam heat. Five more are under installation and additional ones are under consideration in the same mill. Paper Mill Equipment, Ltd.,, P. O. Box 270 has the agency for Canada and Fibre Making Processes, Inc., Chicago have the agency in the Kraft mills of the United States.

SKF Industries Inc.

A machine demonstrating the self-aligning characteristics of ball and roller bearings featured the exhibit of SKF Industries, Inc., Philadelphia. By mechanical means, shaft deflection was exaggerated for the purpose of showing the ability of these bearings to compensate for the unavoidable conditions of misalignment caused by frame distortion or shaft deflection without impairing their full carrying capacity. The self-aligning ball bearing is self-contained and has two rows of balls. The inner surface of the outer race is spherical. The spherical roller bearing is also a self-contained unit. It has barrel-shaped rollers that remain in permanent contact with

Dilts



- **BREAKER BEATERS**—built by Dilts for all types of breaker service—continuous or batch—rugged construction throughout. High performance—low power.
- **BRACED BAR ROLL**—the heart of the breaker beater—the roll—the exclusive all steel braced bar bandless type roll—the strongest construction available anywhere—supported in double suspension spring bearings.
- **BREAKER SYSTEMS**—Cowles Classifiner—settling trough—thickeners—modern stock chests, propeller agitated—Hydrafiners—complete modern stock preparation systems.
- **ABLY ENGINEERED**—for individual requirements. Write for details.

DILTS MACHINE WORKS INC., FULTON, N. Y.

the center flange, assuring positive roller guidance and low frictional characteristics. Nils Miller, Atlanta district manager, was in charge of the exhibit.

Strong, Carlisle & Hammond Co.

The Strong, Carlisle & Hammond Company, Cleveland, Ohio, exhibited several items of its line of steam specialties. The exhibit included open and inverted bucket traps of semi-steel construction and forged steel bucket traps for higher pressure. It also showed pressure reducing valves, strainers and a high pressure Globe valve. It laid particular emphasis on the Anum Metl valves and seats used in its open and inverted bucket traps, which are guaranteed to remain tight in service for one year. It also featured the anti-balancing device for inverted bucket traps. This device consists of a valve arrangement mounted on the lever of the inverted bucket trap and is so arranged that during the cycle of operation, the vent in the bucket is automatically varied according to conditions. The manufacturers claim that this device, which is fully covered by patent, will completely eliminate the tendency to balance or dribble, particularly on low condensate loads. The company also showed photographs and installation drawings of its larger equipment such as draining installation installed at the Savannah plant of the Union Bag and Paper Corporation, handling the condensation from the digester heaters. This plant contains several hundred Strong traps for both medium pressures and their forged steel traps on the 400 lb. super-heat service. The booth was in direct charge of F. L. O'Neil, district manager, and R. L. Clark, in charge of sales, and L. P. Strong, in charge of manufacturing, both of the Cleveland, Ohio, office, also were in attendance.

Testing Machines Inc.

Testing Machines, Inc., 460 West 34th Street, New York, exhibited several of the well-known Schopper Standard Testers used throughout the paper industry in the United States and Canada, including the Schopper-Folding Endurance Tester, Schopper-Riegler Beating and Freeness Tester, the new Variable Speed Drive Schopper Standard Tensile Tester, Schopper Micrometers and Scales and also the latest Schopper development, the new Schopper Bending Fatigue Tester, Model DP5. Mr. Schniewind was in attendance at the booth.

The Texas Co.

The Texas Company occupied booths Nos. 32 and 33. Its space was attractively identified, comfortably appointed and very conveniently located. Those in attendance were E. A. Harper, Chief Lubrication Engineer, G. R. Cheney and F. G. Mitchell.

Wallace & Tiernan Co. Inc.

Wallace & Tiernan Company Inc., Newark, N. J. exhibited the newest and largest of its chlorinators, the High-Capacity Visible Vacuum Master Chlorinator. It is noted that this equipment is particularly suitable to satisfy the high chlorine requirements of the larger pulp and paper mills, both for fresh water and white water treatment for slime control, usually in combination with W & T Ammoniators, for chloramine treatment. The Wallace & Tiernan Master Chlorinator is also well adapted for use in meeting the exacting requirements of multi-stage bleach work. In addition to slime control, the Wallace & Tiernan exhibit featured other control services, including Automatic pH Control, general bleach plant Chlorine Equipment, Dry Chemical Feeders, and Testing Instruments for Chlorine and pH. Wallace & Tiernan were represented by R. B. Martin of the main office in Newark, N. J.; J. R. Hoy of Jacksonville, Fla.; A. R. Murphy and G. R. Cavanaugh of Knoxville, Tenn.; H. F. Davis of Charlotte, N. C.; and Alexander Bell of San Francisco, Cal.

Walworth Co.

One of the features of the Walworth exhibit of valves, fittings, pipe and tools was a six-inch pulp mill valve, Walworth Fig. 725-FS. This is a gate valve made of special iron alloys and designed particularly for use in the pulp and paper industry. Walworth also exhibited one of their new six-inch Series 300 O. S. & Y. Gate Valves, made of cast carbon molybdenum steel, incorporating all the latest engineering features including streamline ports for better flow. There were also on display several high quality Walworth bronze valves including the latest addition to the line, the 350 pound, union bonnet bronze globe valve, Fig. 225-P. This valve has a plug type seat and disc of Stainless Steel, heat treated to a minimum hardness of 500 Brinell. A showing of Lubricated Plug Valves, Cast Alloy Pipe, Walseal Threadless Bronze Fittings, Genuine Stillson Wrenches and Walco Pipe Wrenches completed the exhibit. Walworth representatives in attendance at the exhibit were Walter E. Stevens, Frank H. Cole, T. Gunter Smith, and Milford H. Luttrell.

Worthington Pump & Machinery Co.

The main feature of the exhibit of the Worthington Pump and Machinery Corporation was its type FP centrifugal paper stock pump, suitable for handling the highest consistencies of all kinds of stocks for all services, in pulp and paper mills. A large suction opening insures low velocity and permits low submergence. Unobstructed incoming flow, together with the large stream line of impeller and casing, prevents clogging and air binding with resulting high efficiency. A spare rotating element shown in connection with this pump gave a good view of the combined screw conveyor, radial vane type impeller with open front and back, and extremely large eye of the screw extending far into the suction nozzle. A steep characteristic curve guarantees almost constant capacity at variable suction heads. The exhibit also contained two sizes of the new Worthington chemical pump with all part contacting the liquid made of "Worthite," a high nickel, high chromium, molybdenum, alloy steel, suitable for handling hot sulphite, and sulphurous and sulphuric acids. Worthite is offered for all corrosive conditions in the pulp and paper industry, including alum and bleach solutions. The smaller Worthite pump, Type CG, is available from stock in two sizes for capacities up to 130 g.p.m. and heads up to 70 ft. The pump is mounted on a steel bracket, specially rust-proof, to withstand corrosive atmospheres. The larger Worthite pump shown was typical of the Type CQ (closed impeller) and Type CT (open impeller) pumps, suitable for capacities up to 500 g.p.m. and medium high heads. They are equipped with full adjustable thrust bearings, for accurately positioning the impeller for any operating temperature, and for take-up to compensate wear of the open type impeller.

EVERY DAY new machines are put to work in America's industrial plants to manufacture better commodities at higher speed and lower cost. And each advance gives new impetus to our ever rising standard of living.

To the genius of America's machine designers goes all praise for these achievements.

Yet without a like advancement in the science of lubrication, these modern machines would be of little benefit to industry. For no machine can perform without oil; and with each advance in machine design and speed comes a greater need for effective lubrication.

To deal with the problems that grow out of these mechanical developments, Gulf has equipped its laboratories with instruments and machines that put lubricants to the severest tests.

Behind the scenes of American industry today is a group of Gulf scientists who work each day to find better methods and better oils to lubricate machinery. No lubricant is placed in service in the field until it has been thoroughly proved as best for its purpose.

This is why Gulf can make this pledge to industrial plant operators: *Lubrication will continue to keep pace with the technologic advance of industry.* Gulf has the men, materials and equipment to manufacture the finest oils and greases for the machinery of today—and for the machinery of tomorrow as well.

GULF INDUSTRIAL LUBRICATION

Those Who Attended the Convention

Official Registration of the Technical Association of the Pulp & Paper Industry

A

J. H. Allen, Union Bag & Paper Corp.
Capt. and Mrs. A. T. Akerman, U. S. Engr. Corps.
Mr. and Mrs. W. F. Allen, Union Bag & Paper Corp.
C. J. Austin, Charlotte, N. C.
John B. Allen, Chromium Corporation of America.
G. A. Atkins, Bristol Instrument Co.
Anthony Anable, the Dorr Co.
Mr. and Mrs. Earl F. Anderton, Scott Paper Co.
Mr. and Mrs. H. J. Angell, Goulds Pumps Inc.
M. T. Auchter, Hoberg Paper Mills.
Dana H. Alexander, Clinton Co.
Mr. and Mrs. R. T. Anderson, Paterson Parchment Paper Co.
Dr. G. H. Argue, Fraser Paper Ltd.
Bruce Armstrong, Sprout, Waldron & Co.
Allen Abrams, Marathon Paper Co.
Mr. and Mrs. L. C. Anderson, Ontario Paper Co.

B

E. George Butler, Industrial Committee of Savannah.
Mr. and Mrs. H. G. Bickley, Williamsburg, Pa.
E. C. Boyette, Jr., Charlotte, N. C.
H. G. Blansing, Charlotte, N. C.
T. E. Bell, Atlanta, Ga.
Mr. and Mrs. Rufus L. Baugh, Jr., Pulp and Paper Laboratory.
Chris F. Bingham, Columbia Alkali Corp.
Hubert L. Becher, Homasote Co.
Mr. and Mrs. Gene Bechard, Gene Bechard.
Mr. and Mrs. E. F. Bearce, Chillicothe Paper Co.
Mr. and Mrs. J. N. Broughan, Pennsylvania Fibre Corp.
Mr. and Mrs. H. H. Burrows, Manhattan Rubber Co.
M. H. Boyce, E. I. DuPont de Nemours & Co.
Mr. and Mrs. Wm. E. Brown, American Wringer Co., Inc.
W. M. Bain, Glidden Co.
Mark W. Bray, U. S. Forest Products Laboratories.
Mr. and Mrs. H. T. Baughman, West Virginia Pulp & Paper Co.
C. M. Baker.
J. S. Bates, Price & Pierce Ltd.
C. A. Bentz, Champion Paper & Fibre Co.
Mr. and Mrs. A. F. Bachmann, Missisquoi Corp.
Mr. and Mrs. L. M. Booth, Booth Chemical Co.
A. Bankus, Crown Zellerbach Corp.
Mr. and Mrs. W. E. Baker, N. Y. & Pennsylvania Co., Inc.
A. S. Bedell.
Lyman Beeman, St Regis Paper Co.
W. W. Barrett, Carborundum Co.
Fred V. Bailey, U. S. Rubber Products, Inc.
Clyde A. Benson, American Delthirna Corp.
Paul Boronow, Valley Iron Works.
Paul Bray, University of Maine.
L. I. Brill, Brill Equipment Corp.
C. L. Bachelder, Hercules Powder Co.
Mrs. Walter Boone.
Mr. and Mrs. H. H. Brown.
Arthur M. Brooks, Raffold Process Corp.
V. E. Bailey, Bailey & Beldinger.
Eugene A. Brooks, Boiler Equipment Co.
A. M. Ball, Hercules Powder Co.
Mrs. E. Brannan, B. & W.
G. P. Bowne, Westinghouse Electric & Mfg. Co.
W. L. Bigelow, Bigelow-Liptek Corp.
I. G. Bullard, Corn Products Refining Co.
H. T. Baker, Bagley & Sewall Co.
U. P. Bennett, Dilts Machine Works.
F. H. Bryant, Seaboard Air Line Railway.
T. G. Batchelor, Paper Makers Chemical Corp.
A. K. Birch, Wm. Powell Co.
L. O. Bidstrup, Ingersoll-Rand Co.
R. R. Baker, Westinghouse Electric & Mfg. Co.
Norman Burke, International Paper & Power Co.
C. W. Boyce, American Paper & Pulp Association.
D. L. Bigelow, Philip Carey Co.
L. N. Bent, Hercules Powder Co.
Miss Selma Blair, Assistant to Secretary of TAPPI.
F. N. Beveridge, Kraft Corp. of America.
Mrs. Hildegarde Buffington, TAPPI.

C

Alexander Calder, Union Bag & Paper Corp.
Mr. and Mrs. Austin E. Cotrin, Fort Howard Paper Co.
Ward Converse, Crane Co.
Mr. and Mrs Arthur S. Cosler, Bauer Bros. Co.
Dr. John Campbell, International Paper Co.
Ward Carson.
Mr. and Mrs. Copps, Union Bag & Paper Co.
C. H. Champion, R. T. Vanderbilt Co.
Mr. and Mrs. G. N. Collins, Rust Engineering Co.
C. M. Connor, Valley Forge Labs., Inc.
N. C. Cooper, E. I. Du Pont de Nemours Co., Inc.
Mr. and Mrs. Crain Whiting-Plover Paper Co.
H. D. Cook, Ranier Pulp & Paper Co.
C. L. Clark, Nash Engineering Co.
Mr. and Mrs. J. W. Corriston, E. J. Lavino & Co.
Mr. and Mrs. F. Casciani, Electro Bleaching Gas Co.
Charles W. Cassell, Congoleum-Nairn, Inc.
D. E. Cousins, Champion Paper & Fibre Co.
Mr. and Mrs. A. E. Cadman, Champion Paper & Fibre Co.
Dr. Charles Carpenter, Pulp & Paper Laboratory.
George Carruthers, Interlake Tissue Mills.
Mr. and Mrs. D. B. Chant, Ontario Pulp & Paper Makers.
Arthur A. Cottin, Titanium Pigments Co.
N. W. Caster, Sound View Pulp Co.
J. V. B. Cox, Hercules Powder Co.
George B. Cunningham.
George E. Corson, Clinton Co.
Sax Chaplin, Grinnell Co.
Emil Cyeutz, American Heat Reclaiming Co.
C. C. Cole, Keystone Lime Works.
E. Cowles, Dilts Machine Works.
Hal Cramer, Western Electric & Mfg. Co.
John Cornell, *Paper Mill.*
F. G. Calkin, Solvay Sales Corp.
W. A. Chilson, Hooker Electrochemical Co.
B. E. Claridge, Hammermill Paper Co.
Mr. and Mrs. J. Coghill, Noble & Wood Machine Co.
C. C. Caycel, General Dyestuff Corp.
Mr. and Mrs. Corning, International Paper Co.
E. Chapman, Lukenweld, Inc.
M. H. Courtenay, S. K. F. Industries, Inc.
J. J. Cruden, American Wringer Co.
Mr. and Mrs. Alec Cassels, Chamber of Commerce.
Walter Clifford, Penick & Ford.
A. B. Clarke, J. O. Ross Engineering Corp.
Julian T. Chase, National Aniline Chemical Co.
Richard G. Coker, Carolina Fibre Co.
H. B. Caldwell, Swenson Evaporator Co.

D

V. S. Denison, Beloit Iron Works.
Norman D. Doane, Permutit Co.
Pierre Drewsen, Hinde & Dauch Paper Co.
E. L. Demmon, U. S. Forest Service.
B. W. Denn, E. D. Jones & Co.
F. W. Drake, Lockport Felt Co.
E. H. Driver, American Cyanamid and Chemical Corp.
Mr. and Mrs. W. T. Doyle, Sturtevant Mill Co.
Mr. and Mrs. C. B. Durgin, Monsanto Chemical Co.
R. G. Dunn, Johns-Manville Corp.
F. A. Dennis, Scott Paper Co.
L. A. Dix, Paper & Industrial Appliances, Inc.
Mr. and Mrs. J. Donaldson, Stora Kopparberg Corp.
A. C. Dreshfield, Hercules Powder Co.
J. C. Dieffenderfer, Hercules Powder Co.
W. W. Duecker, Texas Gulf Sulphur Co.
Mr. and Mrs. Roy L. Davis, Detroit Sulphite Pulp & Paper Co.
Mr. and Mrs. R. Duttora, Paterson Parchment Co.
Martin L. Downs, Thilmany Pulp & Paper Co.
L. A. Dillon, A. E. Staley Mfg. Co.
G. M. Dickinson, Sonoco Products Co.
John V. N. Dorr, The Dorr Co.
G. K. Dickerman, Consolidated Water Power & Paper Co.
H. E. Davis, Wallace & Tiernan.
C. M. DeMoccey, Savannah Sugar Refining Corp.
R. Davy, Southern Alkali Corp.
M. S. Doyle, George Supply Co.
Mr. and Mrs. George C. Dunn, Dunn Sulphite Paper Co.
K. M. Dillabough, Solvay Sales Corp.

E

Mr. and Mrs. Enright A. Ellis, Downingtown Mfg. Co.
Mr. and Mrs. Albert Ernest, Union Bag & Paper Co.
E. B. Erichsen, Pagel Horton & Co.
I. F. Eldredge, Sou. Forest Experimental Station.
W. H. Elliott, Elliott Co.
Carl Endlein, A. J. Tagliabue Mfg. Co.
Mr. and Mrs. George A. Engert, Dilts Machine Works.
J. Edge, Downingtown Mfg. Co.
E. O. Ehrhart, Castanea Paper Co.
Lars Ekeland, Helmers Bruks & Fabriks
Homer Eaton, Dilts Machine Works.
C. L. Emerson, Robert & Co.
K. Irar Ekholm, National Aniline & Chemical Co.
Henry O. Ehrisman, Foxboro Co.
Robert Earl, Jr., Earl Paint Corp.
Robert R. Elsasser, Timken Roller Bearing Co.

F

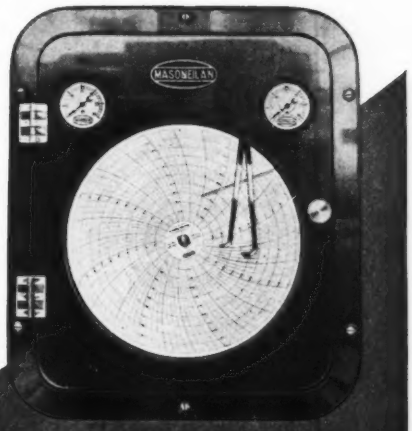
Robert Fechner, Dir. C. C. C., Washington.
Mr. and Mrs. Howard C. Foss, Industrial Committee of Savannah.
J. Foxgrover, Hercules Powder Co.
F. S. Freeman, Ingersoll-Rand Co.
Dr. Carl Fromm, Worthington Pump Corp.
Mr. and Mrs. A. C. Fuller, Worthington Pump Corp.
Joseph S. Fox, Pulp & Paper Laboratory of the Industrial Committee of Savannah.
Miss M. S. Franklin, Pulp & Paper Laboratory of the Industrial Committee of Savannah.
H. W. Fleming, Timken Roller Bearing Co.
A. W. Foley, American Cyanamid and Chemical Corp.
A. B. Feaver, A. E. Reed & Co.
Mr. and Mrs. M. F. Fillius, Eastman Kodak Co.
A. E. H. Fair, Alliance Paper Mills.
Pell W. Foster, Foster-Wheeler Corp.
Dr. H. C. Fleischer, London, England.
Elsie P. Frundt.
Geo. E. Ford, A. P. Green Firebrick Co
Mr. and Mrs. M. F. Flotow, French Paper Co.
Mr. and Mrs. H. J. Farra, Pusey & Jones Corp.
R. R. Fuller, Gulf States Paper Co.
R. W. Franklin, S. F. K. Industries, Inc.
Mr. and Mrs. H. D. Frost, French Paper Co.
S. W. Fletcher, J. O. Ross Engineering Corp.
L. E. Fitzgerald, Hercules Powder Co.
Mr. and Mrs. Chas. E. Fawkes, Pyroxylin Products, Inc.
Harry C. Fisher, Gardner-Richardson Co.
Jas. P. V. Fagan, Puget Sound Pulp & Timber Co.

G

Mr. and Mrs. Robert W. Groves, Savannah Port Authority.
Walter L. Glass, F. C. Huyck & Sons.
Mr. and Mrs. Otto J. Goeppinger, Warren Steam Pump Co., Inc.
Mr. and Mrs. Roger C. Griffin, Cambridge, Mass.
E. P. Gleason, Nekoosa-Edwards Paper Co.
Edwin Grayson, Tennessee-Eastman Corp.
L. R. Growdon, Mead Corp.
P. M. Garrison, Gaylord Container Corp.
W. F. Gillespie, Gaylord Container Corp.
John Gelzer, Westinghouse Electric & Mfg. Co.
Geo. E. Gollop, Canadian Industries, Ltd.
Mr. Gouehnauer, Northern Paper Mills.
F. R. Gibson, Layne-Louisiana Co.
H. Grinstad, Brompton Pulp & Paper Co.
Mr. and Mrs. W. P. Gruendler, Gruendler Crusher & Pulp Co.
Joseph F. Griffin, Gulf Oil Corp.
W. E. Green, Stowe-Woodward, Inc.
Wm. P. Gargan, Goulds Pumps, Inc.
O. P. Gephart, Miamisburg Paper Co.
L. Glorsen.
G. Granger, Koppers Coal Co.
Mr. and Mrs. Alan H. Griffin, Riegel Paper Corp.
W. S. Graham, Koppers Coal Co.
E. Getty, West Virginia Pulp and Paper Co.
R. C. Gabrels, Taylor-Colquilt Co.
J. T. Gamble, Union Bag & Paper Co.
Mr. and Mrs. Fred H. Gayer, Pyroxylin Products Inc.

BOTH *Are Essential*

TO SUCCESSFUL CONTROL



A GOOD INSTRUMENT

MASONEILAN

A Good Instrument with

- Simplicity of construction and operation.
- Easily accessible standardized parts.
- Visible adjustments, made without disturbing chart record.
- Non-bleeding, amplifying pilot of maximum capacity and minimum air consumption.
- The same control system for pressure, temperature, rate of flow or level control.
- Low operating cost, due to standardized parts; simple, sturdy construction; minimum air consumption.

A GOOD VALVE

Bulletin 2345 describes the new Masoneilan controllers and control valves. It is yours for the asking.

A Good Valve in Which

- Ball bearings reduce friction to a minimum.
- Stainless steel (18-8) is used for all parts subject to friction or corrosion.
- Streamlined valve plugs balance out the flow effect, reduce turbulence, cutting, wire drawing.
- Multiple springs and large diaphragms insure sensitivity and stability.
- Pressure lubricator provides grease seal, prolongs life of stem, maintains sensitivity.
- Specially designed air-fin bonnet is provided for use where extreme temperatures are encountered.
- Positive valve positioning is effected without the use of re-positioner accessories except in rare cases.

MASON-NEILAN REGULATOR COMPANY, 1187 ADAMS STREET, BOSTON, MASS., U. S. A.

New York · Philadelphia Pittsburgh Chicago Tulsa St. Louis Houston Los Angeles

H

Charles H. Herty, Dir. Pulp & Paper Lab., Industrial Committee of Savannah.
Robert M. Hirch, Mayor, Savannah.
Mr. and Mrs. J. P. Houlihan, Judge, Chatam Co. Comm.
E. A. Harper, the Texas Co.
Mr. and Mrs. J. W. Hemphill, Johns-Manville Corp.
Roy F. Hayes, Bagley & Sewall Co.
G. A. Hermann, Hermann Mfg. Co.
Carl M. A. Hermelin, American Heat Reclaiming Co.
Mr. and Mrs. Grafton Houston, Fort Howard Paper Co.
James I. Hayes, Bemis Bros. Bag Co.
J. H. Hobson, Gene Bechard.
H. W. Hoefer, Elliott Co.
W. C. Henry, Goulds Pumps Inc.
W. I. Hall, Union Bag & Paper Co.
Mr. and Mrs. D. R. Hettelsater, Freyn Engineering Co.
Mr. and Mrs. R. W. Hamilton, Nashua River Co.
A. A. Harden, Corn Products Refining Co.
Mr. and Mrs. H. S. Hill, Price Bros.
George S. Hendrickson, Republic Flow Meters Co.
Ray E. Harter, R. T. Vanderbilt Co.
H. A. Hamion, Cooke & Huttall.
Mr. and Mrs. K. Hursen.
Mr. and Mrs. L. W. Hopkins, Multi Metal Wire Cloth Co.
Mr. and Mrs. C. M. Howell, Scott Paper Co.
Wm. L. Hall, Masonite Corp.
L. Hebbs, Cross & Bevan.
Mr. and Mrs. H. J. Hosking, Groton Leatherboard Co.
E. O. Houghton.
H. Hammarlund, Hamersley Mfg. Co.
E. A. Holland.
Mr. and Mrs. R. J. Hemphill, General Electric Co.
J. M. Hill, Jr., Babcock & Wilcox Co.
Mr. and Mrs. H. M. Holmes, Hammermill Paper Co.
E. F. Hinner, Hercules Powder Co.
Frank Heyward, Georgia Forest Service.
Mr. and Mrs. John A. Hanson, Badger Paper Mills.
J. R. Hox, Wallace & Tiernan.
Carl A. Hausman, Crouse Hinds Co.
Ward Harrison, Riegel Paper Co.
R. C. Hassinger, Alabama Power Co.
Olle Heabring, Weyerhaeuser Timber Co.
Mr. and Mrs. George R. Heidrich, Wallace & Tiernan.
C. L. Huey, Babcock & Wilcox Co.
A. B. Hansen, Northern Paper Mills.
Paul Hodges, Brunswick Pulp & Paper Co.
Edward H. Hill, West Virginia Pulp & Paper Co.
P. B. Holden, Stowe, Woodward Inc.
J. A. Hamm, Shartle Bros. Machine Co.
C. A. Hulsart, Babcock & Wilcox Co.
Edward A. Hall, Kraft Corp. of America.
M. Harris, Northwest Paper Co.
E. S. Humphreys, Virginia Bridge Co.
C. A. Higgins, Hercules Powder Co.
G. T. Handley, Ohio Knife Co.
C. C. Heritage, Wood Conversion Co.
T. Hasselstrom.

I

Mr. and Mrs. Tom Ireland, Crane Co.
Mr. and Mrs. E. P. Ingalls, S. D. Warren Co.
F. A. Irvine, Marrero, La.
Mr. and Mrs. Chester C. Irving, St. Petersburg, Fla.

J

Mr. and Mrs. Merschel V. Jenkins, *Savannah Morning News.*
Bradley Johnson, Union Bag & Paper Co.
B. Johnsen, Hammermill Paper Co.
M. C. Jones, Michigan Carton Co.
H. W. Johnston, Forest Products Laboratories.
Roy B. Johns, Freeport Sulphur Co.
Herman L. Joachim, H. L. Joachim.
R. G. Johnson, E. B. Eddy Co.
S. B. Jones, West Virginia Pulp & Paper Co
R. H. Jackson, General Electric Co.
Mrs. H. B. Johnson, Union Bag & Paper Co.
M. E. Judd, Dalton, Ga

K

Stig Kempe, Stockholm, Sweden.
C. W. Kramer, Worthington Pump Co.
Mr. and Mrs. M. S. Kahln, Union Bag & Paper Co.
Mr. and Mrs. Paul Kopperman, Jos. Kopperman & Sons.
Thomas Kerr, U. S. Department of Agriculture.
L. H. Keller, Corn Products Sales Co.
A. P. Keisker, Crane Co.
Mr. and Mrs. H. E. Karberg, Alliance Paper Mills.
C. O. Kingsbury, Solvay Sales Corp.
Mr. and Mrs. M. F. Knoch, River Raisin Paper Co.
P. G. Kinken, Champion Paper & Fibre Co.
S. Kuholoiet, Nunat Paper Co.
W. A. Ketchen, Fraser Paper Ltd.
Mr. and Mrs. D. B. Kimball, Eastman Kodak Co.
Marcell Koehne, Gardner-Richardson.
Howard G. Kitt.
W. S. Kidd, E. B. Eddy Co.
Grover Keeth, Marathon Paper Mills.
R. P. Kite, the Dorr Co.
T. E. Kloss, Maine Seaboard Paper Co.
W. C. Kirby, Grinnell Co.
Mr. and Mrs. C. L. Knowles, the Dorr Co.
Eugene J. Kane, American Can Co.
J. D. Kerr, Glidden Co.
Paul Koenig, P. H. Glatfelter Co.
Mr. and Mrs. L. Killam, British Columbia Pulp & Paper Co., Ltd.
M. M. Klosson, Buffalo Pumps, Inc.
L. Knowles, Clinton Co.
H. A. Keene, Grinnell Co.
C. E. Kinney, Hercules Powder Co.
A. J. Kroog, General Electric Co.
Mrs. Carl O. Kingsbury, Solvay Sales Corp.
Helen U. Kiely, American Writing Paper Corp.
Mr. and Mrs. J. M. Keating, Johns-Manville Corp.
Ralph W. Kumler, Bennett, Inc.
Jas. M. Kahn, International Filter Co.

L

T. E. Lagerstrom, International Nickel Co.
E. W. Lawrence, Norma-Hoffmann Bearing Co.
G. C. Lightner, Lightner & Smith.
Joseph D. Lowery, American Cyanamid and Chemical Corp.
Mr. and Mrs. H. W. Laymon, Mead Corp.
Mr. and Mrs. B. J. Larpenteur, the Dorr Co.
E. F. Ledger, Goulds Pumps, Inc.
A. M. Lintock, Texas Gulf Sulphur Co.
H. A. Lubs, E. I. Du Pont de Nemours Co., Inc.
Mrs. E. F. Leger, Goulds Pumps, Inc.
Chester G. Landes, American Cyanamid and Chemical Corp.
L. F. Loutrel, Jr., Merrimac Chemical Co.
Mr. and Mrs. W. P. Lawrence, Champion Paper & Fibre Co.
Mr. and Mrs. J. S. Little, Western Electric Co., Inc.
G. H. Lentz, U. S. Forest Service.
E C. Libby, N. Y. State College of Forestry.
E. S. Lansing, Bagley & Sewall Co.
E. J. Link, Link Paper Co.
J. E. Lockwood, Naval Stores.
A. W. Luhrs, Cont. Testing Laboratory, Inc.
Mr. and Mrs. J. F. Leete, National Sugar Refining Co.
R. H. Lattman, National Container Corp.
F. J. Lammers, International Filter Co.
Geo. O. Lines, Commercial Solvents Corp.
H. A. Lilly, Aluminum Co. of America.
Harry F. Lewis, Institute of Paper Chemistry.
A. J. Luettgen, P. H. Glatfelter Co.
Charles Luginduhl, Moore & Munger.
Harold H. Layritz, Lunkenheimer Co.
M. H. Luttrell, Walworth Co.
Walter Lenz, Fabricas de Papel, S. A.
Hans Lenz, Fabricas de Papel, S. A.

M

B. W. Martin, Gaylord Container Corp.
W. S. Miles, Virginia Bridge Co.
W. P. Maull, Mead Corp.
Mr. and Mrs. D. W. McCready, University of Michigan.
Karl G. Meschke.
A. G. McArthur, Rainier Pulp & Paper Co.
F. M. Meigs, E. I. Du Pont de Nemours & Co. Inc.
Mr. and Mrs. A. W. Miller, Cornell Wood Products.
J. M. Mallory.
Mr. and Mrs. Edward P. Miller, Hoberg Paper Co.
Mr. and Mrs. W. H. Monsson.
W. F. Mitchell, Pennsylvania Salt Mfg. Co.
Mr. and Mrs. J. D. Malcolmson, Robert Gair Co.
Poole Maynard.
Ralph Mair, Krebs Pigment & Color Corp
P. L. McCall, Sonoco Products Co.
Roy H. Marston, Binney-Smith Co.
D. O. Magill, American Can Co.
R. W. Murray.
W. R. Moore, Brown Instrument Co.
M. J. Maguire, Hercules Powder Co.
G. G. Metcalf, Babcock & Wilcox Co.
E. M. Murry, Mathieson Alkali Works.
J. Mazer, Hudson Bay Co.
L. Morris Mitchell, Merritt-Chapman & Scott Co.
D. C. Murchison, Georgia Kaolin Co.
E. D. McKellar, General Electric Co.
George E. Missbach, Mathieson Alkali Works.
Mr. and Mrs. R. B. Martin, Wallace & Tiernan.
Mr. and Mrs. E. J. Monaghan, E. I. Du Pont de Nemours & Co., Inc.
Wm. W. Meekrem, Black-Clawson Co.
H. J. McKenzie, Layne & Bowler.
Lawrence Manning, Morris Machine Works.
W. A. McNaughton, News Print Service Bureau.
H. H. Morrison, Permutit Co.
D. S. Moss, National Aniline Chemical Co.
Teddy R. Moore, Brown Paper Mill Co.
Nils Miller, S. K. F. Industries, Inc.
William Murphy, President City Southern National Bank.
F. W. McGinnis, Barkon Frink Tube Corp.
R. G. Macdonald, Secretary of TAPPI.
Mr. and Mrs. Edward Mayo, Union Bag & Paper Co.
W. L. Mingledorff, Savannah Machinery & Foundry Co.
Mr. and Mrs. D. G. Moon, Union Bag & Paper Co.
W. N. Moore, Savannah Chan. & Supply Co.
S. H. Morgan, Morgan, Inc.
Mr. and Mrs. John J. McDonald, Brown Co.
L. W. Meadow, Jeffery Mfg. Co.
Arnold McAneny, Bradner & Smith & Co.
Mr. and Mrs. Frank S. McCall, Pulp & Paper Laboratory of the Industrial Committee of Savannah.

N

Mr. and Mrs. J. Cheshire Nash, President, Col. Naval Stores.
Mr. and Mrs. G. W. E. Nicholson, Southern Kraft Corp.
A. J. Navarre, St. Joe Paper Co.
R. A. Nugent, Nekoosa Edwards Paper Co.
J. C. Noyes, Jr., Nash Engineering Co.
J. F. Nation, J. M. Tull Metal & Supply Co.
Mr. and Mrs. Charles B. Norris, American Boxboard Co.
A. B. Nixon, Hercules Powder Co.
R. A. Martin, Yarnall Waring Co.
H. C. Moore, Moore Broach Engineering Co.
J. Naegeler, S. E. Clay Co.
J. N. Noble, Improved Paper Machinery Corp.

O

Mr. and Mrs. J. W. Ogden, Foster-Wheeler Corp.
F. L. O'Neil, Strong Carlisle & Hammond Co.
Mr. and Mrs. H. F. Obermann, Hammermill Co.
John J. O'Brien, *Paper Mill.*
Sam L. Olson, Layne Texas Co.
Henry E. Obermans, Hammermill Paper Co.
Eugene W. O'Brien, *Southern Power Journal.*
W. M. Oettmeier, Superior Pine Products Co.

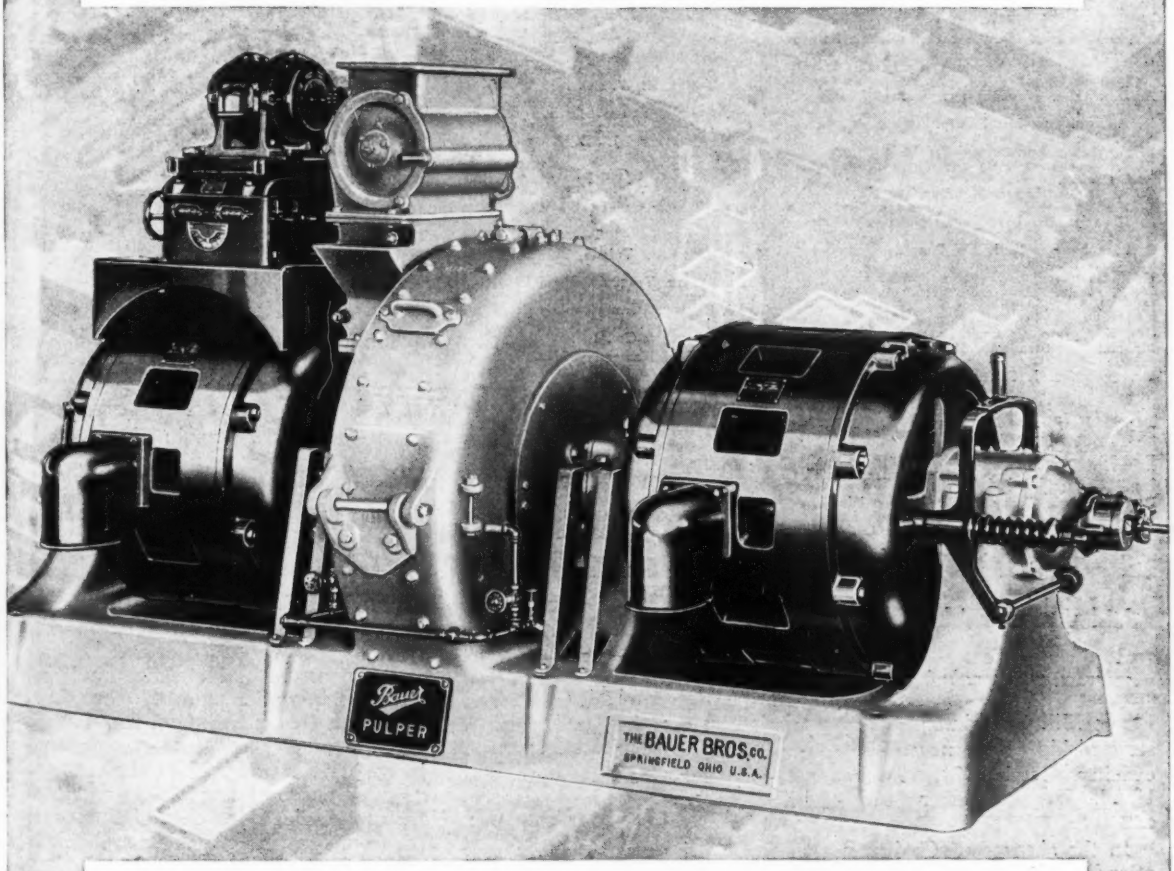
P

M. W. Phelps, Solvay Sales Corp.
T. A. Pascoe, Nekoosa Edwards Paper Co.
J. C. Pullman, Bert C. Miller Inc.
P. H. Prior, A. E. Reed & Co.
Mr. and Mrs. G. D. Pratt, Canadian Industries Ltd.
Mr. and Mrs. Ellis F. Parmenter, Champion Paper & Fibre Co.
J. E. Plumstrad, Jessup & Moore Paper Co.
C. H. Peters, W. S. Tyler Co.
H. B. Preble, Congoleum-Nairn Inc.
J. L. Phillips, Atlantic Coast Line Railroad.
Samuel I. Parker, Ciba Co., Inc.
Chas. J. Prescott, Bennett, Inc.
J. A. Peterson, Rice, Barton & Fales, Inc.
W. E. Penfield, Gulf States Paper Corp.
Jas. E. Power, U. S. Rubber Products, Inc.
E. L. Putter, Heller & Merz Corp.
G. P. Pratney, Bagley & Sewall Co.
E. Peterson, B. F. Goodrich Co.
John L. Purdy, Orr Felt & Blanket Co.
N. J. Pearce, U. S. Rubber Co.
H. O. Pierce, Solvay Sales Corp.
J. H. Persons, General Electric Co.
E. L. Pemberton, National Aniline & Chemical Co.
R. E. Phinney, Kraft Corp. of America.

R

John M. Rittelmeyer, Rittelmeyer & Co.
Mr. and Mrs. R. I. Wynne Roberts, Norton Co.
T. C. Roberts, Beloit Iron Works.
Mr. and Mrs. John D. Robinson.
Mr. and Mrs. O. W. A. Rodowski, Union Bag & Paper Co
Ernest B. Roberts, Benier Bag Co.
Mr. and Mrs. R. C. Richter, Union Bag & Paper Co.
Mr. and Mrs. A. G. Ready, George F. Hardy.
Mr. L. O. Rolleston, International Paper Co.
Geo. J. Rittu, U. S. Forest Service.
L. S. Reid, Metropolitan Life Insurance Co.
J. P. Rubush, Swenson Evaporator Co.
F. G. Rawling, West Virginia Pulp & Paper Co.
Mr. and Mrs. C. F. Richter, Stebbins Engineering & Mfg. Co.
Wm. H. Randolph, Jr., A. E. Staley Mfg. Co.
Henry A. Rothchild, Kimberly-Clark Corp.
Chas. A. Reese, Nekoosa Edwards Paper Co.
H. W. Rogers, General Electric Co.
G. A. Richter, Brown Co.
W. Otis Roe, Dixie-Vortex Co.
J. O. Rue, Hooker Electrochemical Co.
T. H. Rider, H. Waterbury & Sons Co.

The BAUER
PULPER AND REFINER



With double-disc action, the Bauer delivers an outstanding performance in reject refining, in semi-chemical pulp fibration, in paper stock preparation. That is why far more Bauers were sold the first six months of 1937 than in any previous half-year period. • Because there is a real story to tell, we urge you to write the company for the complete information.

THE BAUER BROS. Co. Box 509T Springfield, O.

J. W. Raines, Lindsey Wire Co.
C. P. Robinson.
J. L. Richardson, Gulf States Paper Corp.
Mr. and Mrs. H. M. Rice, E. I. Du Pont de Nemours & Co., Inc.
B. M. Ryan, Asten-Hill Mfg. Co.
B. J. Russell, Kraft Corp. of America.

S

Mr. and Mrs. Ben. O. Sprague, Pres., Savannah Sugar Refining Corp.
Mr. and Mrs. Wm. G. Sutlive, Pres., Chamber of Commerce, Savannah.
Frank M. Sanger, Bagley & Sewall Co.
Mr. and Mrs. A. G. Stone, Southern Kraft Corp.
R. Skagerberg, Brown Instrument Co.
Mr. and Mrs. J. P. Strasser, Stein-Hall Co.
D. G. Sutherland, Sutherland Refiner Corp.
Mr. and Mrs. Dan Stacy, American Box & Board Co.
A. H. Stanton, Mason-Neilan Regulator Co.
H. F. Schenk, Wm. A. Hardy & Sons Co.
E. M. G. Schroder, General Dyestuff Corp.
C. E. Traynor, Union Bag & Paper Co.
H. L. Smith, J. W. Bolton & Sons, Inc.
Mr. and Mrs. B. P. Steele, Pennsylvania Salt Mfg. Co.
N. A. Shepard, American Cyanamid and Chemical Corp.
A. D. Snipes, Westinghouse Electric & Mfg. Co.
K. A. Swenning, Mead Corp.
E. A. Shallcross.
E. R. Shafer, Forest Products Laboratory.
J. N. Stephenson, *Pulp and Paper Magazine of Canada.*
G. A. Sands, Electro-Metallurgical Co.
H. Z. Schniewind, Testing Machines, Inc.
R. H. Simmons, U. S. Government Printing Office.
G. L. Schwartz, E. I. Du Pont de Nemours & Co., Inc.
F. K. Shankweiler, Hercules Powder Co.
W. R. Steele, Solvay Sales Corp.
John Shuber, Solvay Sales Corp.
S. M. Silverstein, Rogers Paper Mfg. Co.
Geo. K. Spence, Castenea Paper Co.
Mr. and Mrs. Steadman, Standard Paper Mfg. Co.
Mr. and Mrs. J. Scheuerman, Cameron Machine Co.
E. B. Severs, United Engineers & Constructors Inc.
Roscoe H. Smith, Reliance Electric & Engineering Co.
Fred Shaneman, Pennsylvania Salt Mfg. Co.
Fred B. Schilling, Nichols Engineering & Research Co.
D. E. Stephan, Chicago Bridge & Iron Works.
L. K. Smith, *Pacific Pulp and Paper Industry.*
J. A. Staidl, Thilmany Pulp & Paper Co.
F. S. Seaborne, Kimberly-Clark Corp.
W. H. Swanson, Kimberly-Clark Corp.
R. R. Schweitzer, L. Atlantic Co.
G. E. Schneider, John Wesley.
T. A. Scott, Merritt-Chapman & Scott Corp.
R. C. Stewart, Black-Clawson Co.
Gunter Smith, Walworth Co.
L. P. Spoon, Course Hinds Co.
W. F. Spoerl, U. S. Rubber Co.
Dr. A. Salathe, Brown Co
F. N. H. Setterwall, A B. Rosenblads Patents.
R. P. Saunders, Brown Insurance Co.
Mr. and Mrs. W. L. Savell, Mathieson Alkali Works.
J. D. Studley, Bureau of Foreign Commerce.
C. M. Shipway, Wm. E. Hooper & Sons Co.
Mr. and Mrs. J. C Schmidt, E I. Du Pont de Nemours & Co., Inc.
D. M. Shapleigh, Hercules Powder Co.
R. R. Staltz, Western Electric Mfg. Co.
F. A. Soderberg, General Dyestuff Corp.
G. F. Scarbrough, Link Belt Co.
Mr. and Mrs. P. McG Shuey, Shuey & Co.
J. R. Slocum, Link Belt Co.
C. R. Stover, Corn Products Refining Co.
E. L. Shuff.
W. F. Swan, Standard Lime & Stone.
P. B. Stall, Hercules Powder Co.
C. P. Shook, Jr., Manhattan Rubber Co.
H. L. Seymour, Phillips Carey Co.
F. L. Smith, Frederick L. Smith.
S. H. Smith, De Laval Steam Turbine Co.
Mr. and Mrs. E. W. Scherer, Brooks Scanlon Corp.
L. P. Strong, Strong, Carlisle & Hammond Co.
S. W. Fletcher, J. D. Row Engineering Corp.
J. I. Seay, Layne Central Co.
C. A. Southwick, Jr., General Foods Co.
F. C. Smith, *Southern Power Journal.*

T

H. A. Tiernan, Toledo Threading Machine Co.
Mr. and Mrs. Traquair, Mead Corp.
H. L. Thompson, Nashua River Paper Co.
T. W. Toovey, Pennsylvania Salt Mfg. Co.
Mr. and Mrs. J. A. Turner, E. I. Du Pont de Nemours & Co., Inc.
Nils G. Thor, Hamersley Mfg. Co.
C. R. Tait, Hammermill Paper Co.
W. H. Toppan, Fibre Making Process Co.,
C. S. Taylor, Riegel Paper Corp.
H. S. Taylor.
F. P. Thornton, Stowe, Woodward Inc.
H. V. Vanberg, A. E. Staley Mfg. Co.
W. D. Taulman, Chapman Valve Co.
L. A. Thompson, Hercules Powder Co.
M. W. Thomas, Kaolin Co.
C. K. Textor, Riegel Paper Corp.
A. B. Taylor, Taylor Colquilt Co.
Mr. and Mrs. G. R. Tennent, Hummel-Ross Fibre Co.
Miss E. Tennent, Hummel-Ross Fibre Co.
W. P. Thieleus, Gulf States Paper Co.

V

Mr. and Mrs. C. C. Van Stry, Cameron Machine Co.
E. Velrick, Dunn Sulphite Paper Co.
M. H. Vaughan, Halifax Paper Co.
L. D. Vining, Kraft Corp. of America.

W

Mr. and Mrs. Woodside, Mathieson Alkali Works.
Mr. and Mrs. T. Guy Woolford, Georgia Forestry Association.
Mr. and Mrs. G. T. Wagner, Union Bag & Paper Co.
Miss Rita Wood, Union Bag & Paper Co.
Mr. and Mrs. E. Wierk, Johnson & Wierk, Inc.
J. L. Wilson, Goulds Pumps, Inc.
Dan M. Wadsworth, Gaylord Container Corp.
Kurt Wandel, Lukenweld, Inc.
Mr. and Mrs. G. C. Walton, Downington Mfg. Co.
Wm. S. Weed, Electro Bleaching Gas Co.
A. W. Wickham, McAndrews & Forbes.
R. A. Wilkins, Bud & Son, Inc.
A. E. Waugh, U. S. Rubber Co.
Mr. and Mrs. C. L. Wagner, Marathon Paper Mills Co.
N. P. Wardwell, Carthage Madison Co.
J. Scott Wardle, Mobile Pulley Machine.
D. B. Williams, Williams Apparatus Co.
W. T. White, Seaboard Air Line Railway.
F. Williams, Williams Apparatus Co.
Rupert E. Wilson, Yale & Towne Mfg. Co.
Gwin A. Whitney, Merritt-Chapman & Scott Co.
A. D. Wooley, Oxford Paper Co.
Frank A. Whittinger, Ciba Co.
Mrs. L. Whitmore, Ciba Co.
Louis B. Wilcox, Arundel Corp.
E. P. Wilson, Brumpton Pulp & Paper Co.
A. E. Wackerman, Seaboard Air Line Railway.
H. E. Weston, *Paper Industry.*
J. R. White, Corn Products Refining Co.
L. S. Wilcoxson, Babcock & Wilcox Co.
S. R. Williamson, Brunswick Pulp & Paper Co.
Carl A. Weston, Combustion Enigineering Co.
Carl T. Welte, Champion Paper & Fibre Co.

Y

Paul R. Yopp, Babcock & Wilcox Co.
J. D. Yoder, Permutit Co.
F. W. Young, Oliver United Filters Corp.
Mr. and Mrs. A. Yroole, Hinde & Dauch Paper Co.

Z

Henry Z. Zeni, American Cyanamid and Chemical Corp.
Erik Zimmerman, Chesapeake Corp.
B. A. Zuettler, Fiber Making Processes, Inc.
E. T. Ziegler, University of Florida.

Michigan Superintendents Meet

[FROM OUR REGULAR CORRESPONDENT]

KALAMAZOO, Mich., October 25, 1937—The first meeting of the Michigan Division of the Pulp and Paper Mill Superintendents' Association, under the stewardship of the new officers, was held Thursday evening, October 21, 1937, at the Park-American Hotel. It was a dinner meeting with thirty-five present.

In the absence of Chairman Dan Stacy, who was attending the TAPPI Convention in Savannah, first Vice-Chairman Ray Barton presided. In his opening remarks, Mr. Barton outlined the different programs under the consideration for the ensuing meetings this winter. The program committee members are Dan Stacy, Leo Willoughby, Elbert Milham, and O. W. Callaghan.

The speakers were F. L. Zellers, whose topic was "Mechanical and Physical Factors Affecting Paper Formation and Quality," and Elbert Milham, who titled his address "Coating Problems." Both talks were ably delivered, being instructive and interesting, and formed a nucleus from which a spirited forum followed, indulged in by the superintendents and sales representatives alike. Superintendents who do not attend the meetings are surely missing something.

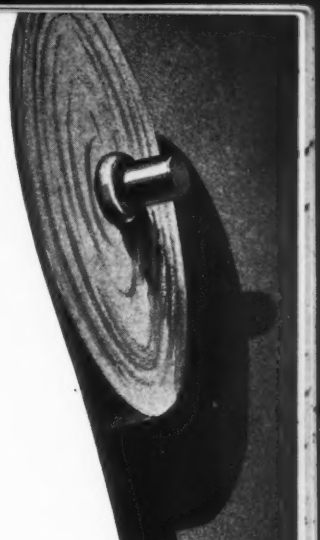
Among those noted at the tables were:

L. M. Mongrieg, U. S. Rubber Company; F. L. Zellers, E. G. Watkins, French Paper Company; F. B. Eilers, Orr Felt Company; Mike Redmond, Kalamazoo Paper Company; Ray Barton, Robert Van Maur, M. S. Fogarty, W. H. Astle, Paul de Guechery, Michigan Paper Company; Arthur W. Cole, E. G. Whittington, Henry Newdorf, Rex Paper Co.; E. G. Milham, Watervliet Paper Company; A. B. Perlick, secretary-treasurer, L. H. LaLiberte, R. B. Stewart, Kalamazoo Vegetable Parchment Company; Norman Cowie, Homer E. Stafford, Hawthorne Paper Company; J. C. Weidmeyer, Allied Paper Company; Walter B. Hadley, Oscar Rowe, Detroit Paper Products Company; J. R. Verdon, W. S. Taylor, D. S. McEachron, V. H. Heinmuller, American Cyanamid and Chemical Corporation; Allen Milham, R. A. Olson, Bryant Paper Company; L. L. Griffith, Heller & Merz Corporation; Arnold Weller, Sutherland Paper Company; R. W. Van Kirk, Penick and Ford Company; O. Flatland, Eddy Paper Corporation; Jake Parent, Noble and Wood Company; C. F. Hutchinson, Buckley Dunton Company; H. E. Stratton, PAPER TRADE JOURNAL.

Pulp Wood Equipment

The Jeffrey Manufacturing Company, of Columbus, Ohio, has just issued Bulletin No. 679, describing the re-chippers, bark shredders and other pulp wood preparation equipment which it manufactures for the paper industry.

Which shall it be—Cotton or Asbestos Dryer Felts?



An impartial survey of dryer felt cost records, covering those mills which have used exclusively either Asbestos or Cotton Dryer Felts, and those which have tried both Asbestos and Cotton, would undoubtedly prove this: that for most of the many different operating conditions in paper mills, *Cotton* Dryer Felts make a far better showing per ton of paper dried.

On the other hand, where speed of production is the one important factor, or where auxiliary drying equipment is inadequate—as well as under other special conditions—the proper Asbestos Dryer Felt frequently shows a lower cost.

There can be no hard and fast rule in the matter, for the simple reason that there are very few hard and fast rules applying to this business of paper making.

However, the point we want to emphasize is this: There is a Hooperwood Dryer Felt—either Cotton or Asbestos—to meet every operating condition; and, whichever type you choose, its tested efficiency and durability will be *woven into* the fabric—*never merely built on to it.*

Samples and prices will be sent gladly on request.

WM. E. HOOPER & SONS COMPANY

General Offices: Juniper and Cherry Sts., Philadelphia · 320 Broadway, New York City · 300 W. Adams St., Chicago, Ill.

Selling Agents: GENE BECHARD, Atlanta, Ga. · HARRY W. STRATTON, Portsmouth, N.H. · M. E. AVERY CO., Watertown, N.Y. · DAN E. CHARLES, Seattle, Wash.

HOOPERWOOD ASBESTOS AND COTTON DRYER FELTS

Newsprint At $50 For Second Half of 1938

Great Northern's Price of $48 Per Ton Complicates Newsprint Situation, Though Lower Price for First Half of Next Year Was Expected — Other Mills Not Obligated to Meet Lower Rate—Oversupply Talk Exaggerated

[FROM OUR REGULAR CORRESPONDENT]

MONTREAL, Que., October 25, 1937—For many people concerned with the newsprint industry the past week has been one of hectic excitement, with a renewal of the controversy over the price level for 1938 coinciding with a stock market break that sent values of newsprint securities tumbling after a long period of steady rise. The situation is still more or less obscure but a moderate recovery in the values of newsprint securities, combined with impressive evidence of the existence of a spirit of cooperation in the industry itself, has done much to calm anxiety. While not altogether unexpected, the announcement by the Great Northern of a price lower by $2 per ton than that announced by the Canadian mills for deliveries during the first half of 1938 has complicated the situation. This does not necessarily mean, as in the past, that all other mills have to quote the same price, for here has been a more or less concerted dropping of the inter-locking clause in contracts, and it is now asserted that as only about 10 per cent of the newsprint contracts of Canadian mills contain this clause the effects of the Great Northern's announcement will not be serious. As a matter of fact in some quarters the Great Northern's announcement is stated to be "definitely constructive." This view seems to be based on the fact that a lower price than $48 had been expected. In any case, a welcome feature of the Great Northern's announcement was the fixing of a $50 a ton price for the second half of 1938, which is a recognition of the need for higher prices, in view of mounting costs.

Mills Stand by $50 Rate

As already announced, leading producers here have reaffirmed their decision to stand by the $50 price for the first six months of 1938 and are meeting the oversupply question, evinced by growing stocks of newsprint, by adopting a working week of five days instead of six.

Oversupply Dangers Exaggerated

R. O. Sweezey and Co., Ltd., a firm whose head is especially prominent in newsprint circles here, expresses the opinion that the dangers of the oversupply situation have been exaggerated. "During the balance of this year," the firm's monthly letter says, "consumption should exceed the production of the mills. Thus the seasonal increase in the demand will tend to reduce the number of day's supply in publishers' hands.

"Based on the figures available to date and the autumnal increase in consumption, we estimate that at the end of the year the publishers' stocks will be only 7.5 days' supply above the average of 1933 to 1936 inclusive. Existing statistics indicate that at the year end publishers will hold about 46 days' supply. In the preceding four years, publishers' holdings ranged from 36 to 45 days' supply. Such a situation would differ materially from recent sombre prognostications.

"In addition, many of the larger mills have decided to operate on a five-day-a-week basis — a development having a decidedly favorable effect on the industry as a whole . . ." "An adequate price is now assured, and after allowing for the stocks in publishers' hands, consumption still satisfactorily continues to exceed last year's levels."

Dealing with the oversupply question, the Quebec *Chronicle-Telegraph* says: "In well-informed circles, recent talk of over-production in the newsprint industry is being deplored as completely misleading and calculated to arouse groundless apprehensions. In particular, surprise is voiced at the bearish comment of certain financial publications that should be broader-visioned and better informed.

"It is true that a number of mills, including Price Bros. and Anglo, are adopting a five-day week but, properly viewed, this is a bull feature. To begin with, the reduction in working hours is the first really constructive measure of which the industry has shown itself capable in the past twenty years.

"Moreover, the cause for the reduction is not a slackening of demand but a greatly accelerated rate of production. Under these circumstances and in view of the tremendous speeding up of plants that has taken place, it is a sound step on which the industry is to be congratulated in thus adjusting its working hours to the actual needs of the changed situation."

Hostels for Lumberjacks

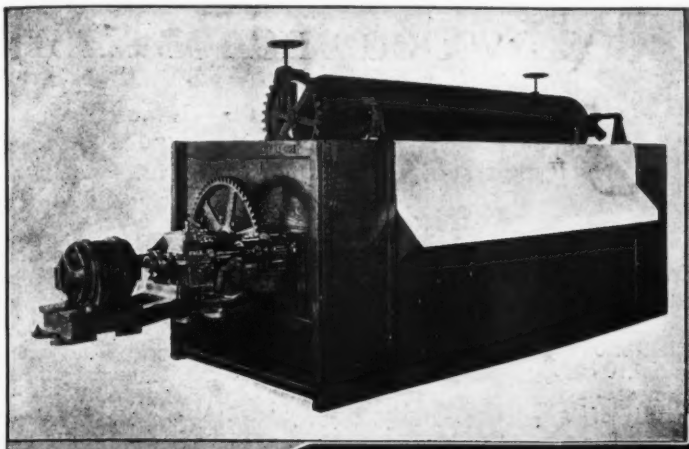
The Quebec Government has accepted in principle the plan put forward by the Union of Catholic Farmers of the Province of Quebec for the construction of two hostels, one in Quebec City and another at La Tuque, for the physical and moral protection of lumberjacks entering and coming out of the woods.

New Screen Engineered by Shartle Bros.

A stock screen based on an entirely new principle of operation is being developed by Shartle Brothers of Middletown, Ohio.

Now in the experimental stage, this new screen, of a rotary type, is said to embody features previously thought impossible to obtain in any screen equipment. Shartle's claim it is designed to cause a stratified separation of impurities. Other features claimed are: gentle pulsation; inward flow; vertical chambers; no horizontal ledges; enormous saving in floor space; easier cleaning; and quiet operation.

Officials of the company point out that not only can plate changes be quickly made, but that it will be possible to clean both sides of the plates without removing hand-hole plates. All is open, nothing is concealed. A substantial reduction of foam and string troubles is also said to be accomplished with the new equipment.



"IMPCO"
Open Cylinder Washer
Thickener or Decker

IMPCO EQUIPMENT

Centrifugal Screens, Flat Screens (Dunbar Drive), Vacuum Filters, Pneumatic Savealls, Washers, Thickeners, Deckers, Cylinder Machines, Wet Machines, "Howe" Collapsible Winder Shafts, Cylinder Moulds, Special Machinery.

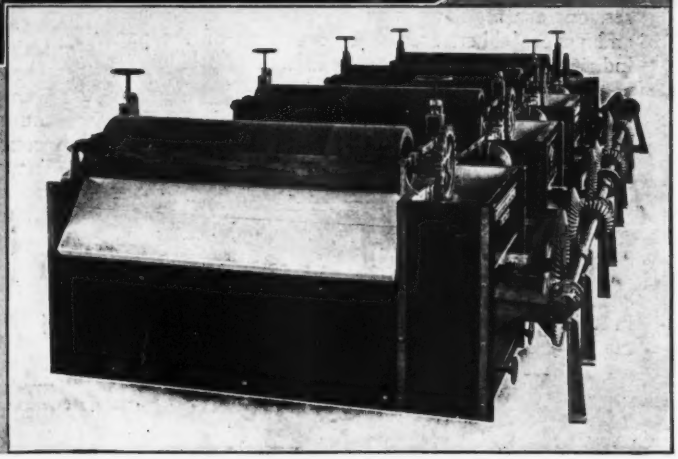
Upon request our representatives are available to make tests and assist mills in planning installations.

IMPROVED PAPER MACHINERY CORPORATION

Nashua - New Hampshire

"IMPCO"
Multiple Stage Washer

consisting of either open or vacuum cylinders with intermediate agitators, used universally for the washing of magazine and other stocks. Furnished in various sizes and styles to meet mill requirements.



Chicago Market Aided by Demand for Kraft

Series of Meetings Stated to Have Heartened Paper Trade—Expert Speaks on Relation of Forestry to Paper Industry—Waste Paper Exports to England—Strike Disturbs Waste Market — Other Industrial News.

[FROM OUR REGULAR CORRESPONDENT]

CHICAGO, Ill., October 25, 1937—A series of important meetings covering the sulphite, writing and kraft paper divisions of the industry, all held in Chicago, are reported to have had a heartening effect on the local trade in these lines. The kraft market is holding firm and it is reported that the firm stand taken by the industry itself is having a salutary effect. The 5 per cent discount formerly allowed to super-jobbers of kraft is reported to now have been extended to include all stocking jobbers. Demand, however, continues slow in the kraft grades. Sulphites picked up noticeably during the week although a part of this improvement was attributed to the fact that buyers who had been holding back because of market uncertainties, came into the picture when conditions firmed up a week ago. Bonds and ledgers in general felt a slight improvement. Books and covers were reported slow. The board market was unchanged while newsprint and ground wood markets were also featureless. Waste papers continued weak with little demand in sight and with prices drifting toward lower levels.

Forestry Expert to Speak

The midwest division of the Salesmen's Association of the Paper Industry is planning a special meeting on Monday, November 8, at which time the members will have the privilege of listening to a talk on the relation of forestry to the paper industry. The speaker will be Mr. R. U. Harmon, supervisor of Superior National Forest with offices in Duluth, Minnesota. Mr. Harmon will exhibit various specimens of wood and of foliage of trees utilized in the manufacturing of paper and will talk on the relationship of forestry and its problems to the paper industry in general. The lecture will cover various growths, fibres and other technical matters which are certain to be of unusual interest to the paper salesmen from a practical sales as well as from an educational standpoint. The meeting, to be held at the Hotel Sherman, which is the place where the S.A.P.I. sessions are regularly staged, is to be an open affair and paper jobbers and other members of the paper industry in the city are being invited to attend.

"New Colors" Merchandised

The paper industry is taking merited interest in the recent mailing by the Gaw-O'Hara Envelope Company which contains reprints of an article on the "Exploration and Discovery of Five New Colors." The message is printed on No. 28, Yellow Glow-Tone which is carried in pink, green, blue, lavender and yellow and in 20, 24 and 28 weights by the envelope manufacturers. The mailing is also used in conjunction with further information covering the Gaw-O'Hara "postage saver" envelope.

Waste Paper Exports to England

Considerable interest is being evidenced in local circles over the reports that a Chicago concern, the James Flett organization with offices at 400 West Madison Street, Chicago, is shipping a considerable amount of waste paper to an English concern. It is understood that over 1000 tons of waste has been shipped including old corrugated waste, mixed papers and news and that this tonnage is expected to eventually total 7000 tons within the next six or seven weeks. The waste paper comes from the nationally distributed sources which provide the supply for this unique organization which merchandises waste paper on a huge scale. Local department stores, nationally known mail order houses headquartering in Chicago, chain units and other sources are undoubtedly contributing to the foreign shipment which is being dispatched from Eastern ports to British board manufacturers.

DePere Making Improvements

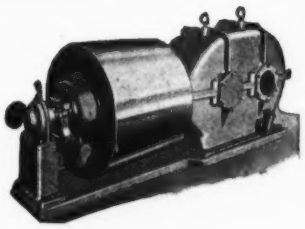
Several major improvements are being made in the DePere, Wisconsin, mills of the Brown County Paper Mills Corporation, according to local information. The Corporation is headed by two Chicagoans, Mrs. B. Frienberg, president, and Harold Schilling, vice-president. The DePere mill employs about 50 men engaged in the making of manilas, wrapping papers and light weight specialties and utilizes waste stock for raw materials. The information states that the mill has been near capacity for several months. The improvements include two new 350 horsepower Keeler boilers which have already been installed and a one hundred foot smoke stack. Improvements and additions have also been made in the beater room and two new beaters added.

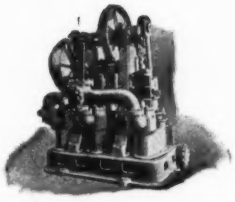
Distributes Gummed Labels

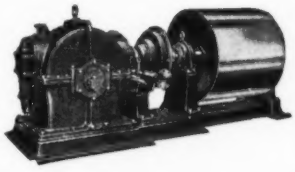
The Mid-States Gummed Paper Company, Chicago, has recently distributed to paper jobbers a quantity of four color 2-1/4 by 1-3/4 gummed stickers to be utilized in stirring up interest among the printing industry in the merchandising of gummed labels. The stickers are of a series, colorful and well suited to do the merchandising job. Irving McHenry, president of the Chicago concern, returned a short time ago from an extensive visit to Europe during which time he visited seven European countries, taking the opportunity to also review the economic conditions in these territories. Mr. McHenry was an Illinois delegate to the International Manufacturers meetings held at Berlin during the late summer period.

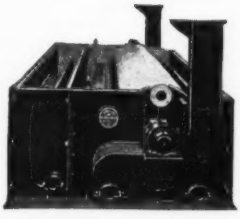
Wausau Producing Bleached Grades

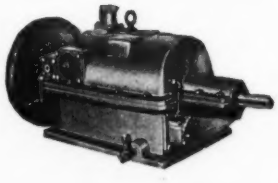
From the Chicago offices of the Wausau Paper Mills at 111 West Washington street, comes the news that the mills of this company are now producing almost 100 per cent bleached grades, the result of a gradual effort to eliminate all other production but the bleached line. M. E. McGarry, a comparative











IT WILL PAY TO MODERNIZE

Quality . . Speed . . Production

● The necessity for modernization is already evidenced by the rebuilding programs now under way in many of the progressive paper mills throughout the country.

The reduction of manufacturing cost and general improvement in range and quality of papers points directly to the advisability of modernizing existing machines, or replacing obsolete equipment with modern units.

The continuous cumulative cost of repairs and shutdowns, with attendant losses in production and quality, soon approaches the cost of new equipment.

During recent years many developments have been brought out, all of which are applicable to existing machines, and in many cases these improvements can be made the means of improving mill conditions without excessive cost.

It is our experience that a preliminary survey and discussion regarding a program for increasing production or improving quality often brings out ways and means for accomplishing the desired results without the expenditure of a great deal of money.

There is always the question as to whether it is advisable from an economy standpoint to rebuild or replace certain parts. These are matters which we will be glad to discuss and attempt to formulate a program which will be mutually advantageous.

An opportunity to discuss possible requirements will be appreciated, and preliminary surveys made without obligation.

★ ★ ★

THE BAGLEY & SEWALL COMPANY

WATERTOWN, NEW YORK

THE MARK OF CRAFTSMANSHIP

newcomer to the Chicago paper circles, is the local sales manager of the Wisconsin firm.

Institute Solicits Ad Specimens

The American Institute of Graphic Arts is still accepting advertising specimens for the forthcoming Commercial Printing Exhibit which will be held at the Newberry Library during the week of December 6. Mr. H. L. Robertson, 732 Sherman street, is the executive to whom the specimens are being sent from all parts of the country.

Strike Disturbs Waste Paper Market

A peddlers' strike is contributing to the unsatisfactory conditions in local waste paper markets where extreme quietness prevails. Shipments to mills have been considerably below last month's tonnage and a substantial reduction in incoming waste paper is the result of the above mentioned strike. A perplexing situation prevails, for with the market quiet even though supply is drying up because of the strike, even less beneficial results should occur from the conclusion of the strike which would, of course, materially increase the quantity of waste papers on hand. What effect this resumption of supply will have on the weakened price structure is certain to be interesting to local observers.

Specifications for Writing Papers

Washington, D. C., October 20, 1937

EDITOR PAPER TRADE JOURNAL:

The comments contained in your September 30, 1937 issue of PAPER TRADE JOURNAL, relative to our news item concerning specifications for writing papers, which was published in your preceding issue, have come to our attention and we hope that in fairness to this Bureau and in the interest of sound paper technology, you will publish the following statements in one of your subsequent issues.

The following statement is contained in the first paragraph of the comments:

"These specifications in certain items have been termed inaccurate by competent authorities in the industry, and the methods given have not been approved as stated in the release by the writing paper manufacturers".

The actual statement contained in our news release to which this has reference, is as follows:

"The specification is based on the results of extensive investigation of record papers in the paper section of the Bureau, practical experience of members of the section in the industry, and advice received from some of the writing paper manufacturers".

You will note that in no way does this imply that the specifications were indorsed by writing paper manufacturers.

In the third paragraph, this statement is made:

". . . . . 'Shall be 100 per cent bleached chemical fiber' is stated to be a radical departure from the usual method of specifying fibrous material used in paper making".

It is true that the recommended classification of the Bureau is a radical departure from the trade custom of classification but even to the non-technical person, it should be clear that any fiber can be ruined in the course of paper manufacture, and sometimes is. Therefore, the trade classification which is based on the source of the paper fiber is obviously fallacious.

In the fifth paragraph the following statement is made:

"The reliability of these tests on finished paper is still regarded as doubtful, because the use of sizings, coloring matter and filling materials present in finished paper, affect these tests".

Improved procedures for the tests mentioned have now been developed which permit the determination of alpha cellulose in all kinds of papers and the determination of copper number in all kinds of paper except those containing zinc sulphide pigments.

Referring to the following statement contained in the sixth paragraph:

"It would not seem necessary to include both a specification of the quality of the paper and of the method by which it shall be made".

Our suggested scheme of specification is much further from a component specification than the scheme of specification prevailing in the paper industry. Our requirements are based entirely on the degree of purity of the paper and its performance under accelerated aging and under strength tests.

The last paragraph is a reflection on the several very competent commercial laboratories which specialize in paper testing. At least six of these have the facilities and experience required for satisfactory services with respect to all of the best methods mentioned in our proposed specifications.

L. J. BRIGGS, Director
National Bureau of Standards

New England Paper Men Meet

BOSTON, Mass., October 25, 1937—The regular monthly meeting of the New England Paper Merchants Association was held at the Hotel Touraine Thursday evening, with about 25 members present and two business sessions.

At the Wrapping Session, with John R. Halkyard, of the Providence Paper Company, Providence, R. I., presiding, John C. Hurd, executive secretary of the Association, made the report of the Gummed Tape Committee, noting encouraging progress on a proposition of a re-sale schedule in this commodity.

The Fine Paper Session, with J. Frank Halloran, of the Century Paper Company, Boston, presiding, was devoted to a discussion of the current market for book papers.

After the dinner, at which President Frank H. Winter presided, F. Bendel Tracy, president of the National Paper Trade Association, commented on the Chicago Convention. John H. Brewer, vice-president and general manager of Storrs & Bement Company, and one of the representatives to the National Paper Trade Association Convention, spoke on the vital importance of association work under present conditions.

Sells Machinery at Leesburg Mill

The Brill Equipment Corporation of 193 Varick street, New York City, has recently purchased the complete plant and property of the former Grass Fibre Pulp and Paper Corporation at Leesburg, Fla. This plant had a capacity of 30,000 pounds per twenty-four hours, manufacturing paper from saw-grass. The plant is now being liquidated and the machinery and equipment is available for sale. There is a local representative on the premises.

The Star-Nosed Mole, greatest tunnel-maker on earth . . . or in it . . . can burrow 105 feet in twenty-four hours. This industrious little animal is able to make such progress because his snout is specially designed for excavating, and his forefeet are shaped like shovels for removing the loose earth. Mother Nature has also provided the Mole with one of the most unusual fur coats in the world . . . smooth, soft, silky . . . this plush-like fur can be rubbed in either direction without fluffing up . . . not impeding him in any way as he travels backward or forward through his narrow underground passageways.

Smooth Finish

WITH BENNETT ROSIN-WAX SIZE

Papers and boards sized with Bennett Rosin-Wax Size have a smooth, velvety feel unobtainable by any other method of sizing. Paper makers can distinguish this characteristic feel . . . even blindfolded . . . and know that it is the ear-mark of superior quality. When paper is sized with rosin size, the fibres are surrounded by a hard, brittle coating which is shattered upon calendering, thus destroying the finish to a certain extent. When Bennett Rosin-Wax Size is used, the paper fibres are coated with a plastic film which on calendering yields a smooth texture. The presence of even a small percentage of wax also tends to lay the fuzz, and eliminate felt marks . . . thus Bennett Rosin-Wax Size gives a better printing surface and decreases the two-sidedness of the sheet.

EMULSION PROCESSES

Our technical representatives are trained engineers. Present your sizing problems to them whenever they call at your plant, and feel confident of professional service and advice, without charge or obligation.

BENNETT INCORPORATED

ORIGINATORS OF ROSIN-WAX SIZE

General Offices: Cambridge, Mass. ● Plants: Lawrence, Mass., Cincinnati, Ohio, Chambly, Que., Hyde, England

Financial News of Pulp and Paper Industry

International Paper Files With SEC Covering Over 3½ Million Common Shares — Container Corp. Reports Net Profit — Brown Reorganization Plan Progresses — Kimberly-Clark Earnings Doubled — Other News.

New York Stock Exchange

High, Low and Last for the Week Ending October 27, 1937

	High	Low	Last
A. P. W.	5	4	4⅜
Armstrong Cork Co.	41	35½	40¾
Celotex Corp.	27	22	27
Celotex Corp., pf.	60	52	56
Certain-Teed Products Corp.	7⅛	6	6⅝
Certain-Teed Products Corp., pf.	31¾	25	28
Champion Paper & Fibre Co.	37	33	34½
Champion Paper & Fibre Co., pf.	107	105	107
Congoleum-Nairn Co.	28	24¼	24¼
Container Corp. of Amer.	17⅝	15	16⅛
Continental-Diamond Fibre Co.	12	10	10⅞
Crown-Zellerbach Co.	13¾	11⅛	12½
Flintkote Co.	16⅜	13½	15¼
Robert Gair	6¾	5⅜	5⅝
Robert Gair, pf.	24¼	22½	23¼
International Paper & Power	12⅛	8¾	10
International Paper & Power, pf.	49¾	39½	44
Johns-Manville Corp.	87	79	84
Johns-Manville Corp., pf.	123½	123½	123½
Kimberly-Clark Corp.	25	22½	24
MacAndrews & Forbes	29¾	28	29½
Masonite Corp.	31	26½	29
Mead Corp.	16¼	14½	15⅜
Mead Corp., pf.	83	83	83
Paraffine Companies, Inc.	45	41½	42
Paraffine Companies, pf.	95⅛	95⅛	95⅛
Ruberoid Co.	24	20¼	24
Scott Paper Co.	36½	36	36
Sutherland Paper Co.	25	20¼	24
Union Bag & Paper Corp.	11¼	9⅜	11
United Paperboard Co.	5⅞	4¾	5¼
U. S. Gypsum Co.	73½	63	63
U. S. Gypsum Co., pf.	159	158¼	159

New York Curb Exchange

High, Low and Last for the Week Ending October 27, 1937

	High	Low	Last
American Box Board Co.	13	10½	12½
Brown Co., pf.	45	37	40
St. Lawrence Co.	6¼	6¼	6¼
St. Regis Paper Co.	4½	3⅜	4
St. Regis Paper Co., pf.	71	71	71
Taggart Corp.	6⅞	5¼	6

International Files Statement

WASHINGTON, D. C., October 27, 1937—International Paper and Power Company, Boston, Mass., has filed a registration statement with the Federal Securities & Exchange Commission under the Securities Act of 1933, covering 3,672,153-23/40 shares of $15 par value common stock, and scrip certificates representing fractional shares of common stock of which 2,324,405 shares are for conversion of the company's cumulative convertible 5 per cent preferred stock and 1,347,748-23/40 shares are reserved for the exercise of outstanding common stock purchase warrants.

The company's outstanding cumulative convertible 5 per cent preferred stock is convertible into fully paid shares of common stock any time on or after November 8, 1937 on the basis of the original conversion price of $40 a share, or 2½ shares of common for each share of preferred.

The outstanding common stock purchase warrants entitle the holder to purchase the number of fully paid shares of common stock specified in the warrant at a basic option price of $25 a share. The initial date for the exercise of the warrants, the company states, is the date upon which the registration statement becomes effective, and the expiration date will be "as many days after May 14, 1942 as the date upon which this registration statement becomes effective is after October 15, 1937."

The company states that none of the shares will be separately offered for sale but are to be issued only after conversion of the preferred stock and for exercise of the common stock purchase shares. None of the shares are to be underwritten.

According to the registration statement, any funds which may be received upon the exercise of the common stock purchase warrants will be used by the company for general purposes including the making of advances to subsidiaries for use in acquiring additional properties, retiring debt, or any other proper company purpose.

Container Corp. Makes Good Report

[FROM OUR REGULAR CORRESPONDENT]

CHICAGO, October 25, 1937—Container Corporation of America's net earnings for the third quarter were $426,462 compared with $405,987 for a similar period of a year ago or 55 cents a share on the larger number of outstanding shares compared with 62 cents a share for last year's period, according to an announcement last week by Walter P. Paepcke, president.

For nine months ended September 30th, earnings were $1,745,756 or $2.23 a share compared with $857,832 or $1.31 a share for nine months ended September 30, 1936. For the last twelve month period, earnings were $2,174,866 or $2.78 per share compared with $1,269,522 or $1.94 per share for the twelve-month period ending September 30th, 1936. In each instance, earnings are computed after all charges including reserve for year end adjustments, Federal Income Tax and estimated surtax on undistributed earnings.

The Company's Fernandina (Florida) pulp mill is expected to be ready for preliminary operation within thirty days; the first fires were started under the boilers last week.

The directors declared a regular dividend of 30 cents a share payable November 20th to stockholders of record November 5.

Brown Survey Basis of New Capital Plan

In a letter to holders of the $21,415,000 Brown Company first mortgage bonds, the bondholders' protective committee, of which Charles Francis Adams is chairman, states that reports, likely to be filed within a few days, are expected "to provide the basis on which a proper plan of reorganization may be developed and presented to the security holders."

The committee states that it has been considering plans of reorganization that would place the company "in a strong and vigorous position in the pulp and paper industry." After the reports covering the survey are rendered and studied, the committee will review its contemplated plans in the light of the important information furnished by the survey and will communicate its recommendations to the bondholders.

"In the meantime," the letter says, "the committee advises bondholders to approve no plan until they have had an opportunity to review the proposals and recommendations that will be made by this committee."

With respect to the plan which the debtor company has proposed, the committee declares that, after full study, it is of the opinion that "the plan as presented is not sound or practical, is not feasible and is not in the best interests of the bondholders or of the company or of the communities in which the company's New England operations are carried on as a whole."

The new information which the committee believes may pave the way for a proper reorganization plan will be obtained from a survey ordered by the Federal Court, the results of which are expected to be available within a few days. This survey is to consist of a report by engineers covering earning power, working capital requirements and other problems; a report from paper engineers on rehabilitation in Berlin, N. H., and expansion in Canada, and a report by a forester covering the woods situation of the company.

Kimberly-Clark Earnings Doubled

[FROM OUR REGULAR CORRESPONDENT]

APPLETON, Wis., October 25, 1937—Net profits of $1,245,738 were reported last week by the Kimberly-Clark Corporation, Neenah, Wis., for the nine-month period ending September 30, 1937. This is more than double the first nine months of 1936, when the net earnings were $577,464.

There has been a notable increase in sales, with a volume of $6,421,512 reported for the third quarter. For the first nine months of this year they totalled $20,260,458, against $16,726,680 for the corresponding period in 1936.

Earnings available for common stock amounted to $322,194 for the third quarter, equal to 66 cents per share on 488,173 shares. They were 34 cents for the same 1936 quarter. This is after deduction of $149,445 for preferred dividends.

Net profit of the corporation for the nine months' period is equal to $2.55 a share on common, against $1.18 a share for the corresponding 1936 period. Dividends of $448,335 were paid during this period on preferred.

For the nine months' period, the earnings for common stock totalled $1,527,759, which is equal to $3.13 a share as against $721,949 in the comparable 1936 period, or $1.48 a share. These earnings were after dividends on preferred stock of $597,780. Computations are net after provision for all charges, including undistributed profits tax.

Johns-Manville Earns $4,592,191

The Johns-Manville Corporation and subsidiary companies showed for the nine months ended on September 30 consolidated net profits of $4,592,191 after all charges, including provision for depreciation, depletion and income tax accrual but before provision for surtax on undistributed income, Lewis H. Brown, president, announced last week. This was equivalent, after preferred dividends, to $4.94 a share on the 850,000 shares of common stock outstanding at the close of the period. It represents an increase of $1,498,630 compared to earnings of $3,093,561 in the first nine months of 1936, equal to $3.16 a share on the present capitalization.

Sales during the first nine months of this year aggregated $46,188,836 or a gain of 33 per cent over sales of $34,733,034 in the comparable 1936 period. Manufacturing cost, selling and administrative expenses for the period increased $9,068,721 or 30.9 per cent from $29,388,569 to $38,457,290, Income tax accrual totaled $1,258,360 an increase of $532,217 over last year.

The consolidated net profit for the third quarter was shown as $1,780,857 or $1.94 a common share after allowing for preferred dividends. The net profit in the September quarter of 1936 was $1,618,659 or $1.75 a share on the same basis.

Dixie-Vortex Earnings Rise

The Dixie-Vortex Company, experiencing a good summer season, expects earnings for 1937 to show a material increase over last year according to R. C. Fenner, president. The company, makers of paper cups, dishes and containers, had a net income of $875,527 for 1936, equal to $4.90 a share on the $2.50 dividend class A stock and after dividend requirements on this issue to $2.11 a share on the common stock. Dividends paid in 1936 on the common stock totaled $1.50 a share. The Dixie-Vortex organization recently leased a plant in California which is expected to be in operation late in January of next year. West coast requirements will be filled from the California factory, the specialties and special manufacturing articles continuing to be made in Chicago and Easton, Pa.

Badger Mills' Earnings Up

APPLETON, Wis., October 25, 1937—Earnings of Badger Paper Mills., Inc., Peshtigo, Wis., continue to show steady improvement over a year ago, directors were informed at their meeting last week. Capacity production, which has been in effect all year, will continue on that basis, according to the present outlook. The directors voted the regular quarterly dividend of 75 cents a share on preferred, payable November 1 to stock of record October 20. They also voted a dividend of 50 cents a share on common, payable October 25 to stock of record October 15.

Hoberg Reports Net Profit

APPLETON, Wis., October 25, 1937—Net profits of the Hoberg Paper Mills, Inc., Green Bay, Wis., for the seven months period ending July 31 are reported at $194,209, after all charges except the tax on undistributed profits, according to announcement of officials. After deducting $23,234 for dividends on preferred stock, the earnings on common of $170,975 are equal to $9.15 per share before deduction of undistributed profits tax.

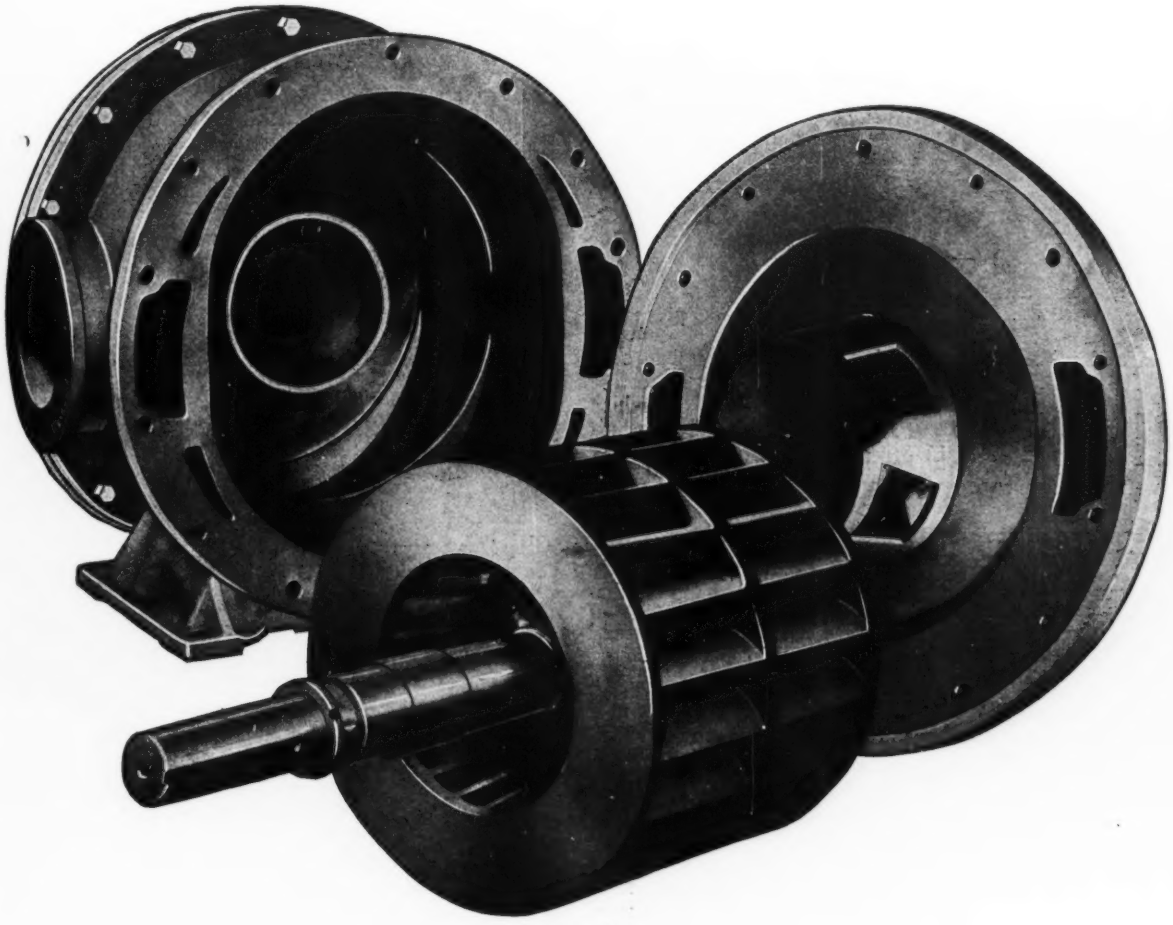
Sales in the seven month period showed an increase of 31½ per cent over 1936 for the corresponding period. Bond interest requirements of $25,841 were thus covered eight and half times.

Mica Insulating Material

The uses of "Micabond," a bonded mica insulating material, is the subject of a booklet issued by the Continental-Diamond Fibre Company, of Newark, Del. The properties, sizes and specifications of the product in plates, sheets and tubing in round, square, oval and other desired shapes are fully described.

SIMPLICITY!

NASH VACUUM PUMPS HAVE ONE MOVING PART.



Operating advantages made possible by the Nash principle, and present in no other type of vacuum pump, permit a new level of operating economy. Nash Vacuum Pumps have but one moving part, a rotor cast in one piece, and revolving without metallic contact. There are no valves, no pistons or sliding vanes, no internal parts requiring wear adjustment, or lubrication.

Vacuum produced by a Nash Pump is non-pulsating without equalizing tanks. Liquid entering the pump does no harm, even in slugs. Reliability and durability are inherent in the simple Nash construction, and these qualities are assured by superior material and workmanship.

THE NASH ENGINEERING COMPANY

SOUTH NORWALK, CONNECTICUT, U. S. A.

Saturation of Absorbent Papers with Rubber Latex*

M. J. Vittengl[1]

Here we are concerning ourselves with what to a layman would seem to be a perfectly easy task: namely, the rubberization of fibrous webs through the medium of rubber latex. Quite simple—merely a two-component system with paper-making fibers as the predominant constituent and rubber as the sub-dominant member, or as might be stated in other words, fiber as the continuous phase and rubber as the disperse phase. This has been the cause of many heart-aches in the past and even today is a potential pitfall for the unwary experimenter who would rush into the production stage without adequate development background. It is my purpose to enumerate some of the salient angles to this partnership between fiber and rubber latex.

That the combination may be considered in the light of paper-making fibers as the dominant factor and rubber as the sub-dominant factor is true only as to the physical extent to which these constituents are present in commercial products today—which products range from 60 to 85 per cent in fiber constituents and 40 to 15 per cent in rubber. Aside from this quantity consideration, rubber plays the important role and causes practically all of the difficulties.

Particle Composition of Latex

Latex is a milky liquid which consists of extremely small discrete particles of rubber suspended or dispersed in an aqueous medium. The microscope even at low magnification shows that we are dealing not with a homogeneous true solution, but with a dispersion. The individual particles are in constant Brownian movement, and the particle size is not uniform. These two facts are extremely important when we come to the application of rubber latex in the impregnating operation.

The actual size of the particles in Hevea latex varies between 0.5 - 3.0 mu. (1 mu. = 0.000,039,4-inch) on the minor axis and 4 to 5 mu. along the major axis. From this you will deduce that the latex particle is not spherical but on the contrary it is usually pear shaped.

The number of such particles present in a small volume of latex is enormous. Henri, an early investigator, has determined that in latex of 8.7 per cent concentration 1 cc. contains 50,000,000 particles. In 35 per cent normal latex we would find 201,150,000 particles per cc. or 200 billion per litre.

Process Obstacles

In short the rubberizing of fibers with latex involves the ushering of 200 billion unruly particles per litre in an orderly manner to their proper places in the interstices of a paper web and insuring that they stay in their proper places. In addition to this there are the problems with which every rubberizer is familiar, but which paper technologists often fail to consider with consequent sad results: namely, protection against oxidation and decomposition. Rubber latex has a tendency to be affected by oxygen in the air and thereby to be changed to a brittle resinous state of matter. Naturally this condition is not satisfactory where flexibility is paramount; hence this tendency must be overcome in the utilization of rubber latex. Certain metals, notably copper and manganese, exercise a very deleterious effect on the rubber particles, causing them to lose their nerve or elastic strength and to reduce them first to a tacky condition and then to a stiff brittle state. Therefore these metals must be rigorously avoided in all machine parts, and naturally they cannot be tolerated in paper webs which are to be saturated.

History of Processes

It is apparent that the conception of using rubber latex in forming paper-making fibers into sheets is not new, but it must be pointed out that early attempts to use latex in this operation were very crude and did not approach the results obtained within recent years. This advance has been due to improvements in paper-making technique and in methods of handling, compounding, and applying latex.

The use of latex in treating paper-making fibers dates back to Hancock's patent[2] in which he treats fibers such as flax, hemp, cotton, and the like by placing them in layers upon a smooth inclined surface and then saturating the fibers with latex in this position. A further patent[3] embraces a process for treating rags and other fibrous materials with latex after they have been beaten to form a pulp or slurry.

Dry Web Saturation

Aside from these patent activities little practical work was done with latex in connection with paper in the early 1800's, and the first commercial application of rubber to paper was made by saturating dry paper with gasoline solutions of rubber. The use of latex was discouraged because of its scarcity and the resultant high cost of the small amount available. By 1850, however, it was found possible to stabilize rubber latex by the addition of ammonia and thus allow shipment of the latex without the fear of spoilage en route. With the advent of rubber latex in commercial quantities it was natural that it should be applied to the problem of saturating paper and we find a British patent issued to Hancock in 1864 and a United States patent, No. 72,287, issued to Bishop in 1868 covering the impregnation of paper with rubber latex. More recently we find United States patent No. 1,526,984 issued to Hopkinson in 1925 covering the same idea.

Beater Application of Latex

Saturating dry paper with rubber saturants was the only method of incorporating rubber into paper until

---

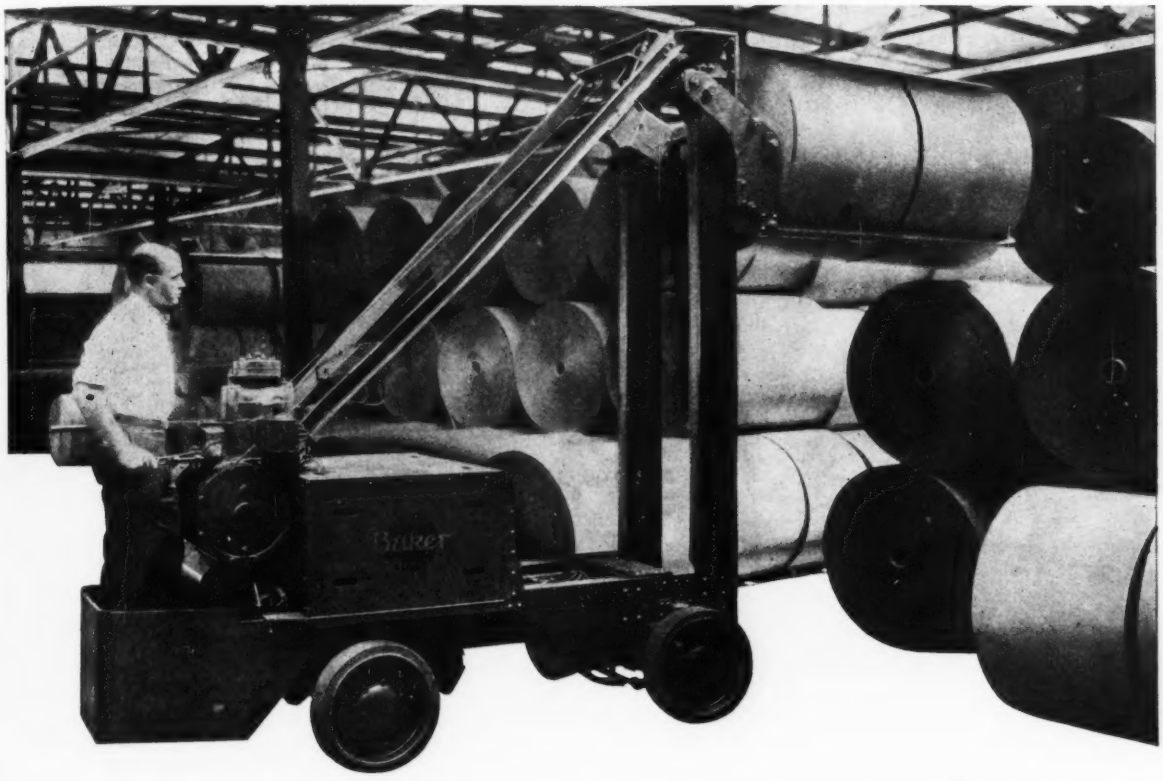
* Paper read at meeting of Delaware Valley Section, Technical Association of the Pulp and Paper Industry, May 21, 1937, Philadelphia, Pa.

[1] Plant manager, Vinton Mills, E. I. du Pont de Nemours & Co., Inc., Brattleboro, Vt.

[2] British patent No. 5,045 dated 1825.

[3] British patent No. 5.970 dated 1830.

ROLL UP!



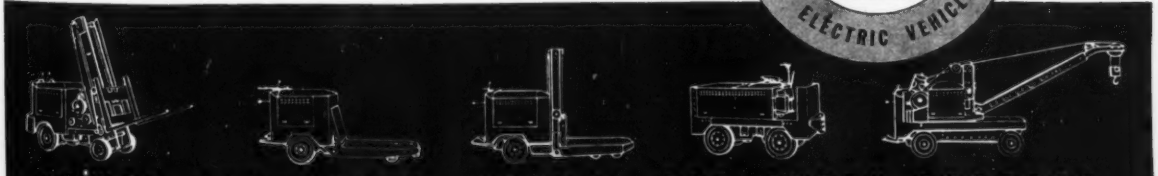
BAKER INDUSTRIAL TRUCKS, especially adapted to the requirements of the paper industry, effect substantial increases in storage space, promote ease and speed in handling, and are rolling up interesting records of lowered handling costs. Mills are finding, too, that the sturdy construction of Bakers and their unusually low maintenance costs extend these savings through many years of active, profitable service.

Get the facts on Baker savings from the Baker Materials Handling Engineer. His accurate, detailed records of performance and savings will be helpful to you in determining the value of Bakers in your plant. Write the INDUSTRIAL TRUCK DIVISION *of the Baker-Raulang Company,* 2162 W. 25th St., Cleveland, Ohio.

OLDEST MANUFACTURER OF ELECTRIC VEHICLES

Baker

TRADE-MARK REG. U. S. PAT. OFF.



POWER INDUSTRIAL TRUCKS FOR EVERY PURPOSE

1924 when a signal advance in the art was made by Kaye who added rubber latex to paper-making fibers in the beater and formed the resultant mass into paper in the usual manner on a paper machine. This process is covered by U. S. patent No. 1,500,500, issued to Kaye in 1924.

Wet Web Process

In 1934 the latest step in the application of rubber latex to paper was introduced when United States patent No. 1,966,458 was issued to Novak covering the process of saturating a wet web of paper-making fibers in a continuous fashion in a routine paper-making operation.

For producing rubberized fibrous products today, three commercial processes are herewith described.

Dry Web Saturation

In the dry sheet saturation process the paper-making fibers are beaten to the desired degree and then formed into paper and dried on a paper-making machine in the usual manner. The resultant paper is subsequently treated with rubber latex to effect rubberization. This saturation is carried on as a separate disassociated operation with the accompanying coagulation and drying in a different location in the same mill or oftentimes in a separate mill.

Beater Application

In the beater process the paper-making fibers are beaten to a certain degree. At this point rubber latex is introduced into the beater and thoroughly mixed with the pulp. A coagulating agent is then added to precipitate the rubber. The resultant rubber treated pulp is then formed into paper and dried on regular paper-making equipment. The paper-making and saturating operations are continuous, being performed in consecutive stages on the same paper-making unit.

Saturation of Wet Web

In the wet web saturation process the paper-making fibers are beaten to the desired extent. The resultant pulp is formed into paper in the usual manner but the wet web issuing from the press rolls, instead of going to the driers, is passed through a bath of latex, and the excess latex is removed from the sheet by squeeze rolls; after which operation the wet, latex-saturated sheet is dried in the usual manner. As in the beater process, this method is continuously completed on the same machine.

Wet Web vs. Dry Saturation

In brief, the advantages of the wet web process over the dry sheet saturation method are: (1) lower labor and operating costs; (2) greater versatility with respect to fibers suitable for treatment; (3) better quality products. A comparison of these two methods is discussed below.

Operating Cost

The obvious outstanding difference between the wet web process and the dry sheet saturation method is that the former consists of a single continuous operation from fiber to saturated paper while the latter is a two-stage discontinuous process with two separate drying operations. The dry sheet saturation involves an extra handling, between the forming and saturating operations, which always result in some damage and loss of paper. Also the wet web method eliminates the cost of all intermediate handling charges entailed by the dry sheet method as well as the cost of the extra drying operation.

Saturability

The wet web process is more versatile in its application to the problem of rubberizing paper than is the dry sheet saturation method. For successful operation of the dry sheet method the paper must be saturable. In this process the saturant must have free access via the interstices of the paper to the interior of the sheet. The size of these interstices determines the speed of infiltration of the saturant, and in the case of suspensions or emulsions it also determines whether the saturating solids will penetrate into the sheet or will be filtered out on the surface. In the case of rubber latex, which is a dispersion of rubber particles in water, a very open structure is necessary to allow infiltration of the rubber particles. This means that the sheet must be porous, and the fiber in turn must be of a definite soft bulky nature. This definitely limits the scope of the utility of this method. It is impossible to saturate a dry sheet of Kraft paper or any other hard fiber with rubber latex. In fact, the only fibers suitable for use in this process are highly refined wood fiber such as Alpha Web, highly curled wood fibers such as Krafelt, and such soft stocks as rag, cotton, digested rope, etc. The inherently saturable fibers are the most expensive, and in order to make saturable the inherently unsaturable fibres, it is necessary to treat them either mechanically or chemically, which operation is also costly. In contrast to the material limitations imposed on the dry sheet saturation method, the wet web process will operate on any fiber irrespective of its inherent characteristics of saturability in the dry state, and thus the hard cheap fibers as well as the soft, more expensive ones can be used. This is due to the fact that saturation is effected while the web is wet and the latex is able to penetrate into the sheet along the watery canals already provided.

Uniformity of Penetration

Finally, even in the case of a saturable fiber, the wet web process will yield a more uniformly latex saturated product than the dry saturation method. In the case of the dry sheet method the saturating solids are progressively concentrated during penetration of the saturant into the sheet, and the result is a product having more rubber in the exterior fibers than in the interior fibers. This phenomenon is due to the rapid absorption of moisture by the dry fibers which tends to concentrate the saturating solids in the first wave of saturant meeting the dry web. This concentrated material has lower mobility or penetrability than the more dilute material behind the initial wave and effectively slows up penetration into the interior of the sheet. In the wet web method, on the other hand, the fibers are already wet with water and do not tend to concentrate the saturant; hence uniform, rapid infiltration of the saturating solids is facilitated, and the resultant product is more uniformly impregnated with rubber.

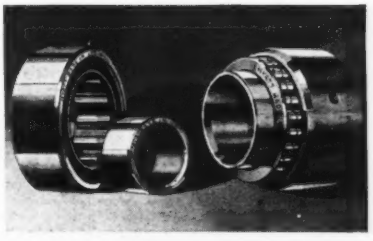
Wet Web vs. Beater Saturation

While both the wet web method and the beater process are continuous in their nature, the advantages of the former over the latter are threefold: greater rub-

RELIABILITY, in the machines you build or use, starts at the bearing points! Use Hyatt Roller Bearings with complete assurance that they will give you longer life under heavy loads, keep related parts in alignment, resist wear, minimize maintenance, and transmit the full measure of power. Not because of any secret formulae, but because of the advanced design by Hyatt engineers and precision manufacture of Hyatt craftsmen.

Evidence of Hyatt reliability is found everywhere in industry... wherever shafts, gears and wheels turn...in mill and factory, on the farm, on railways and highways. Certainly these bearings have a tough life, but, fortified by nearly fifty years' experience in building better bearings, Hyatts definitely have proved they can take it. Hyatt Bearings Division, General Motors Corporation, P. O. Box 476, Newark, New Jersey.

HYATT
ROLLER BEARINGS

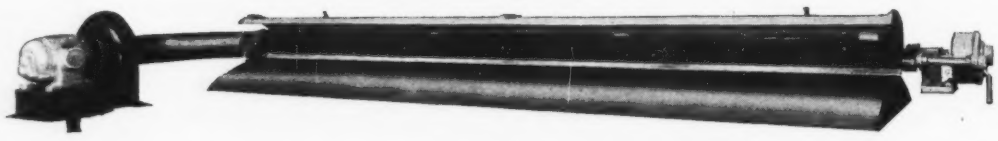


KEEP YOUR MILL ··CLEAN··

With—

THE BROUGHTON OSCILLATING FUZZ COLLECTOR

INSURES the constant removal of all fuzz, dirt, and scale skinned from the dryers by the doctor blade. It helps to keep the dryers clean, which, in turn, keeps the sheet clean. It increases drying efficiency. The oscillating doctor blade and Fuzz Collector operate continuously and the dryer remains polished. Applying the BROUGHTON OSCILLATING FUZZ COLLECTOR to the first dryer is usually sufficient to clean up the balance of the machine. Fuzz and dirt are removed by motor driven suction fan creating vacuum through hinged hood which automatically raises and kills vacuum when broke comes in contact with it. Removing fuzz and scale when formed on first dryer stops it from carry-over to following dryers and necessity to blow or suck it away periodically.



BROUGHTON OSCILLATING FUZZ COLLECTOR

Above—Hood Open for cleaning

Below—Hood Closed for operation

12 REASONS WHY!

Polishes dryers	Improves lubrication	Decreases fire hazard
Stops dust carryover	Decreases maintenance	Helps drying conditions
Decreases abrasion	Saves labor of cleaning	Improves finish
Oscillation stops scoring	Decreases machine room dust	Makes cleaner product

Patented U. S. February 24, 1931 No. 1,794,058
February 24, 1931 No. 1,794,059

Patented Canada May 13, 1930 No. 300,033
Other Patents Applied for

A. E. BROUGHTON & CO. Glens Falls, N. Y.

BROUGHTON OSCILLATORS

FOR DOCTOR BLADES, SHOWERS and FLAT BOXES

SIZE "A" For dandy showers and any other light oscillating duty

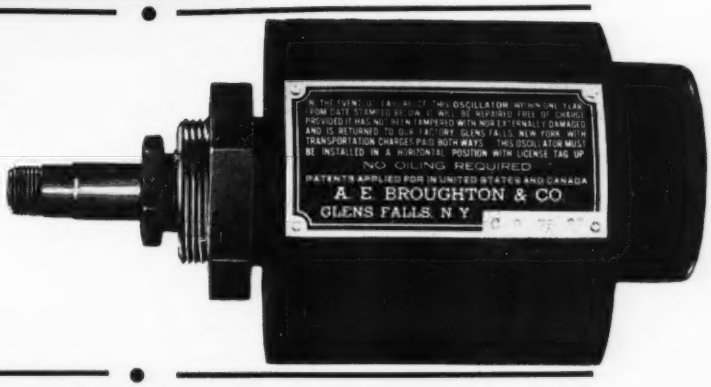
35# Push, 1½" stroke at 15" of vacuum

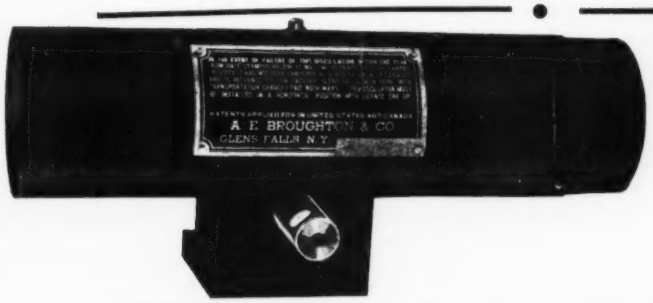
Price $67.00

SIZE "C" For all medium size doctors and showers. A perfect oscillator for doctors

90# Push, ¾" stroke at 15" of vacuum

Price $80.00





SIZE "AL" For Side oscillating showers over head boxes, flat screens. 35# twist 90° at 15" of vacuum.

Price $91.00

SIZE "E" A powerful oscillator for long heavy doctors and showers. Will operate press and calender stack doctors and even flat box oscillation

200# Push, ¾" stroke at 15" of vacuum

Price $95.00

All Prices F.O.B. Factory and Subject To Change Without Notice. For Any Stroke Other than Standard, Prices Will Be Furnished Upon Application

Patents applied for—United States and Canada

A. E. BROUGHTON & CO. Glens Falls, N. Y.

ber efficiency; greater paper efficiency, and less subject to difficulties in operation.

Fiber Concentration

It is a chemical fact that no attraction exists between fiber and wet rubber; consequently the efficiency of any process depends entirely on the probability of fibers entangling the particles of rubber in the latex. In view of this fact the most effective process, from the standpoint of rubber efficiency, is that process in which the concentration of fiber is highest.

Considering the fiber concentration of both processes in the light of this axiom, it is pointed out that in the beater process the latex is added to a slurry of approximately 4 per cent fiber and 96 per cent water; whereas, in the case of the wet web process, the latex is added to a wet sheet having a composition of approximately 40 per cent fiber and 60 per cent water. Again, in the case of the beater process, after the addition of latex to the beater, the latex-fiber-water slurry is diluted with water to approximately 0.4 per cent solids and 99.6 per cent liquids at the paper machine, and any unattached rubber particles are lost at this point.

Water Solubles

In the beater process, the extreme dilution results in a high loss of the water soluble constituents of the latex whereas in the wet web process no dilution occurs, and all water solubles are left in the sheet. Inasmuch as these water soluble materials contain valuable natural rubber antioxidants, it is desirable to retain them in the sheet.

Rubber Cohesion

The product of the beater process as it emerges from the system is harsh and paperlike, and in order to bring out the rubber characteristics it is necessary to use excessive pressure to cause the discrete rubber particles to cohere. In the wet web process, on the other hand, the product is mellow or rubbery without recourse to this excessive pressing operation. This fact would indicate that the beater process yields a product in which the rubber is present as isolated particles; whereas the wet saturation process yields a product in which the rubber is present as a coherent film.

Formation Efficiency

The next point of advantage of the wet web process over the beater process lies in the field of paper efficiency. In the wet web system the fiber is treated to yield the best possible stock from a paper-making standpoint. This stock is then made into paper in the best paper-making manner, and finally this well-made paper is saturated with latex.

The beater process, on the other hand, represents a compromise between good paper making and optimum rubber efficiency. The beater process militates against good paper making because the presence of the rubber particles tends to keep the fibers separated and thus prevents close felting or interlocking of the fibers. In a good paper the fibers are closely interlocked, and the rubber particles act to prevent this action; hence only mediocre formation or felting is obtained in the finished product. Another point to be considered is that of the fouling characteristics of the rubber upon the screens and felts of the paper machines. To reduce this tendency for the "gumming" of the felts by the rubber the latex may be compounded with agents which reduce the adhesiveness of the rubber particles. This non-adhesive characteristic, however, will persist even in the finished sheet; thus a stock with good running characteristics tends to yield poor rubber utilization.

Possible Spoilage Loss

The final advantage of the wet web process over the beater process lies in the greater "foolproofness" of the former. In the beater process the latex is added to the beater, and if the resultant stock does not yield good paper, the only alternative is to dump the beater to the sewer. In the wet web process, on the other hand, the fiber is made into a good sheet of paper before it is ever fed into the saturator. Until the sheet is correct, the wet web is returned as "broke" to the beater, and in this way there is practically no loss due to sheet adjustments.

Of the three processes considered the wet web saturation method appears to be preferable not only from the viewpoint of cost, but also because it lends itself to more efficient operation. In connection with any of the three methods highly technical consideration is necessary to practical, efficient manufacture of a uniform quality product.

European Paper Men Visit Kalamazoo

[FROM OUR REGULAR CORRESPONDENT]

KALAMAZOO, Mich., October 25, 1937—A group of forty-three European paper manufacturers and paper mill officials stopped off in Kalamazoo on October 20 and inspected several of the mills here. Representatives from Germany, Italy, Switzerland, Holland, Austria, Belgium, Finland, Poland and Jugo-Slavia were included in the party. Six members of the group were women.

According to Dr. Gunther von Otto, director of the Thodeshen Papierfabrik Company of Dresden, the purpose of the tour is to observe industrial conditions in this country, especially in the paper industry, make a study of social conditions of the workmen and the handling of raw materials and methods of selling.

Several members of the group were in Kalamazoo when a similar tour was made last year. Dr. von Otto declared in an interview that social conditions of the paper mills in Europe have been vastly improved in the last few years. Most of the governments of Europe have provided insurance covering the workmen in case of illness or unemployment, besides providing old age benefits and a program to assist the men after working hours.

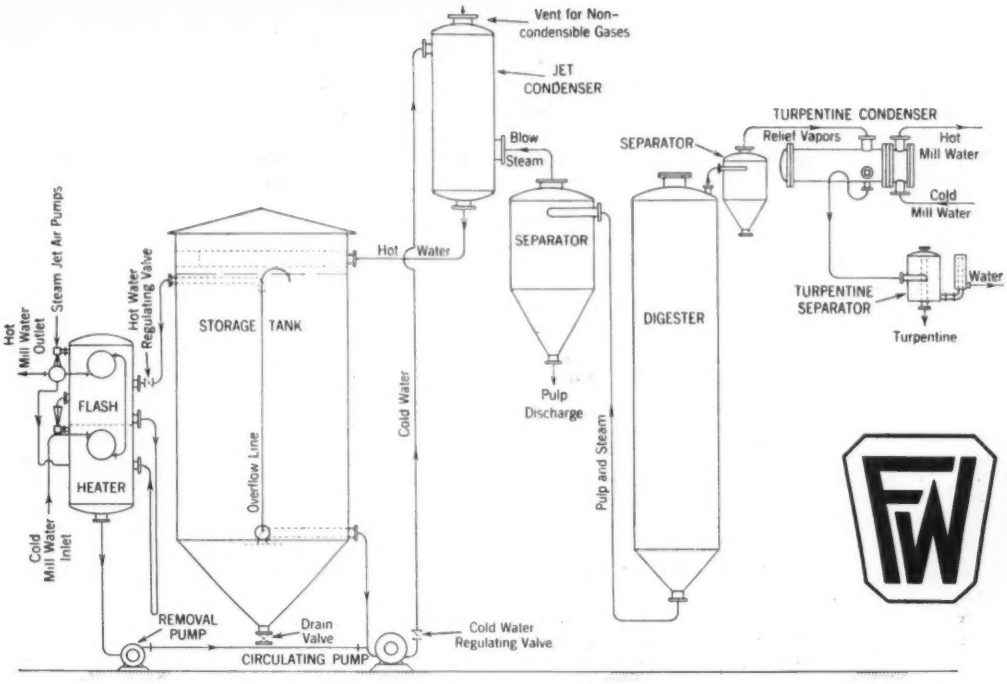
The tour was under the direction of a representative of the Travel Bureau of the American Express Company.

The party left here for Green Bay and Neenah-Menasha, Wisconsin, and will return to New York by way of Washington and Philadelphia.

Seeks Rayon Pulp Orders in Italy

Edward M. Graham, president of Eastern Manufacturing Co. of Maine, paper and pulp manufacturers, has sailed for Italy where, according to the *Boston News Bureau*, it is understood he will confer with Italian textile interests on possible contracts for rayon pulp. Mr. Graham is expected to be away six weeks

Recover
2,085,000 B.t.u. per ton of pulp



A digester, blown down while under 100-lb. pressure, wastes 2,085,000 B.t.u. per ton of pulp. The jet condenser system, as shown, recovers this heat in the form of clean, hot water—a constant requirement in pulp and paper processing.

Blow-down steam, led into the bottom of the jet condenser and up over a series of distributing plates, is condensed by a counter current stream of cooling water, the non-condensable gases venting at the top. From the storage tank, the hot, dirty condensate is flashed into steam and this heat is transferred to clean mill water.

Distinctive features of this design are: Fully automatic operation within close limits of mill water temperatures.

Clogging from pulp cannot occur.

Non-condensable gases may be burned or recovered readily, since entrained moisture is cooled to within a few degrees of entering cooling water.

FOSTER WHEELER CORPORATION
165 Broadway, New York, N. Y.

FOSTER WHEELER

Memorial Plaque to Robert Gair Unveiled

Saturday afternoon a bronze memorial plaque, erected by the Gair Old Timers Association to the memory of Robert Gair was unveiled at the corner of York and Washington streets, Brooklyn, N. Y. Short addresses were made by William W. Fitzhugh, Jr., president of the association and president of William Fitzhugh, Inc., Brooklyn; P. F. Gaffney, vice-president of Densen-Banner Company, Ridgefield Park, N. J., and other members of the association.

Bas Relief Portrait by Joseph Nicolosi

The plaque contains a bas relief portrait of Mr. Gair by Joseph Nicolosi, and the following inscription:

ROBERT GAIR
1839-1927
Captain Union Army
Leader of Men
Pioneer in Industry

His creative genius helped to lay the foundation of modern methods in Packaging and Merchandising.

His Character, Example and Precepts established in Industry high standards of ethics and practices which will leave their mark on future generations.

In recognition of his Leadership and as a tribute to his Memory, this tablet is erected by the Association of Gair Old Timers.

October, 1937

The Gair Old Timers Association is an unique organization of some 400 members, without dues, individual responsibilities, or benefits. It was organized in 1933 by several men who had worked for Robert Gair Company, Inc., New York City, who decided it would be desirable to renew old friendships and have a dinner. The expectation was a dinner for about twenty-five, but the list, which was confined to those who were or had been employed by the Gair Company for ten years, grew and 168 sat down to dinner in 1933, and more than 125 each year thereafter. Of the group, which is now organized in an informal way, about 60 per cent are former employees of the Gair Company and 40 per cent present employees.

The 1937 dinner was held at the Hotel New Yorker, following the unveiling ceremonies.

Officers of the Association

The present officers of the association are:

Honorary Chairman, George W. Gair, Chairman of the Board of Robert Gair Company, Inc., New York City; Honorary President, Harry Adriance, Queens Borough Gas and Electric Company, Far Rockaway, N. Y.; President, William W. Fitzhugh, Jr., president, William W. Fitzhugh, Inc., Brooklyn, N. Y.; Vice-President, Harold Hughes, Export Manager, Parsons & Whittemore, New York City; Secretary and Treasurer, W. F. Howell, secretary, Robert Gair Company, Inc., 155 East 44th street, New York City.

A Leading Industrialist

Robert Gair, the founder, in 1864, of Robert Gair Company, Inc., in whose memory this plaque is erected, was, for many years, one of Brooklyn's leading industrialists. Born in 1839, he served throughout the Civil War in the Union Army, from which he was mustered out a Captain. Within sixty days he established himself in business at 143 Reade street, New York, as a paper jobber. The business gradually expanded to include envelopes, printed sacks, billheads, circulars, etc., and was designated as "job and ornamental job printer." Even hoop-skirt bags were included in the expanded line. His business prospered. Mr. Gair was a Scotchman, a pioneer, upright, simple living, and physically and mentally stronger than most. He had an inventive mind, and while possessed of no formal mechanical education, had an almost uncanny mechanical instinct, which told him whether or not a new machine was right and practical. He was a shrewd trader and had an almost unbelievable capacity for work. He had a flair for merchandising his own products and those of his customers. Lewis Mumford has said: "Robert Gair was a figure; to understand him, to understand the industry he helped to create is to have a keener insight into the material force of modern civilization. More than any personality except that of Roebling, the creator of the Brooklyn Bridge, Robert Gair most certainly dominated the Brooklyn waterfront."

Moved Plant to Brooklyn in 1888

During this early period Mr. Gair made certain machines for the manufacture of corrugated paper, and he evolved the principle of cutting and creasing folding cartons in a single operation. In 1888 Mr. Gair moved his plant to Brooklyn. He built building after building until his factories and real estate holdings became a city within a city, and was commonly called "Gairville." He built the first reinforced concrete building for factory purposes, and continued to build until he had over two million square feet of floor area.

Soundness of Principles Demonstrated

That the principles upon which Mr. Gair built his business were sound, is demonstrated by the fact that the company which he founded remains an important factor in the industry today.

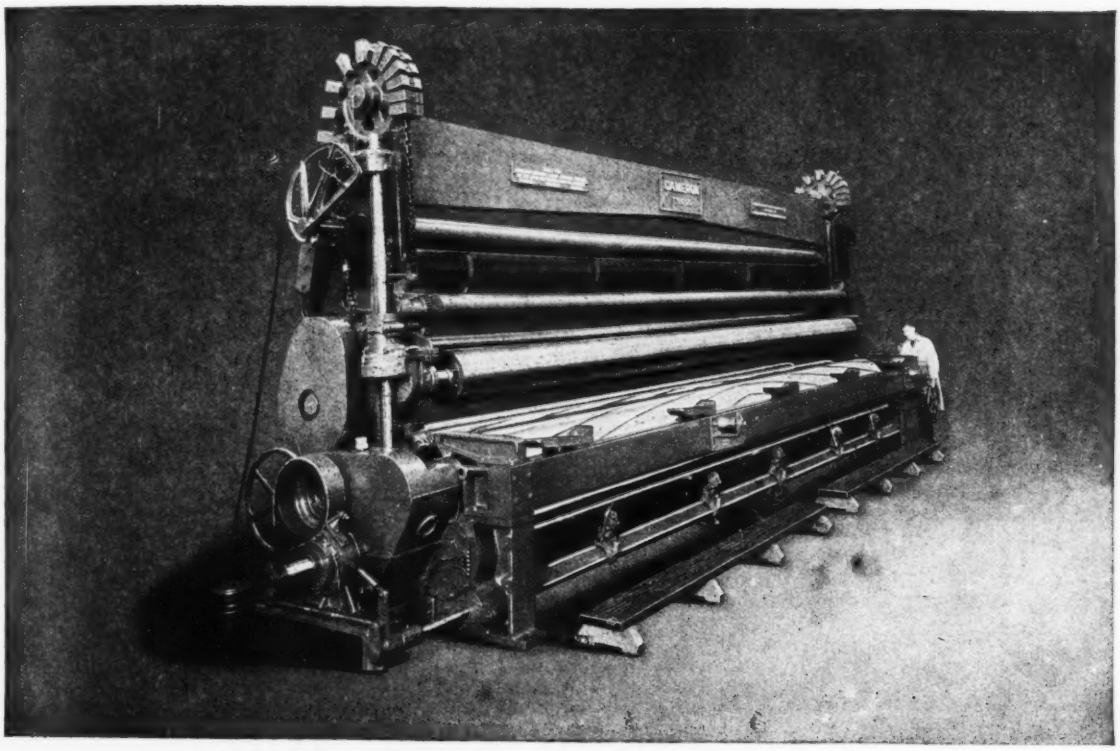
The inventive genius and progressive attitude of Mr. Gair, linked with the growth of advertising, and the progress in the art of filling and sealing by machinery, were largely responsible for the growth of advertised brands of merchandise in this country. He was one of those lesser known industrialists whose name will become more prominent with the present inclination of historians to give more attention to the influence of trade upon a country's history.

C. G. Parker Elected to Board

[FROM OUR REGULAR CORRESPONDENT]

APPLETON, Wis., October 25, 1937—At a regular meeting of the board of directors of the Kimberly-Clark Corporation, Neenah, Wis., October 18, Cola G. Parker was elected as a member of the board and of the executive committee. He also was elected to a vice-presidency in the corporation.

Mr. Parker recently gave up law practice with a prominent New York City firm to become associated with Kimberly-Clark. He recently took up residence at Appleton, Wis.



SPEND GOOD MONEY ONLY FOR GOOD WINDERS

Spending good money on detailed improvements of old style winders is always more or less disappointing. So is saving on the purchase price on new installations, choosing winders on price rather than proven performance. Where is the percentage in providing the most practical means for handling every operation in a mill from the pulp to the reels and then letting down on the winder?

What's the use of grooming a good horse for a race and ther hitching him to a hay wagon? What is the use of making first rate paper and then winding it into second rate rolls? Or if the paper is not exactly first rate then at least make first rate rolls. For the roll often helps to sell the paper. Good paper in good rolls will almost sell itself, but in poor rolls it requires considerable selling. Besides the best roll winders are also the most economical to operate.

CAMERON MACHINE COMPANY—BROOKLYN, N. Y.

Obituary

Frank D. Cashin

Frank D. Cashin, aged 50 years, president of the Cashin Glazed Paper Company, of West Haven, Conn., died at his home of a heart attack, October 14.

Mr. Cashin returned to his home from his place of business and was resting before dinner when he was seized with the attack. He died before medical aid could be summoned.

He was widely known in West Haven and had been president of the glazed paper company for the past 20 years. He was associated in this business with his sister, Miss Ruby M. Cashin of West Haven.

Born in Springfield, Mass., the son of William and Olioine C. Cashin, Mr. Cashin came to West Haven 20 years ago to accept the post of president of the paper company. He was a member of the Holy Name Society of St. Lawrence Church and of the New Haven Lodge of Elks.

He leaves his wife, Mae Riederich Cashin; a son, Gordon F. Cashin; a sister, Ruby M. Cashin; and two brothers, William F., of West Haven, and Edwin E. Cashin of New York.

Thomas J. Wilson

[FROM OUR REGULAR CORRESPONDENT]

DAYTON, Ohio, October 25, 1937—Funeral services for Thomas J. Wilson, 63, veteran reporter and state editor of the *Dayton Daily News,* who died at 10:45 P. M., Saturday, October 9, from pneumonia, were held Wednesday at 8:30 A. M., from the residence and at 9:00 A. M. from Emanuel Church.

Mr. Wilson started his career on the *Daily News* 46 years ago and served in practically every editorial capacity during that time. He had been ill but a week at the time of his death in the Good Samaritan hospital.

At the time of his death he was state editor of The *Daily News;* also Dayton, Ohio, correspondent for the *Cincinnati Enquirer,* and for the past 32 years had contributed articles to THE PAPER TRADE JOURNAL of New York.

Surviving him are his widow, three sons and two daughters.

Charles A. Coombs

NATICK, Mass., October 18, 1937—Charles A. Coombs, 80, secretary and treasurer of the Natick Box & Board Company, died here Tuesday at the Leonard Morse Hospital.

Mr. Coombs was born in Rockland, Me. In 1890, he established a box and board company in Hudson, Mass. and in 1896 removed the business to its present location. In 1914, he built a mill for the manufacture of box board.

Mr. Coombs was an active Mason. The Shrine was one of the Masonic bodies of which he was a member.

Harry Murphy

TORONTO, Ont., October 18, 1937—Harry Murphy, unsuccessful Liberal Candidate for Fort William in the recent Provincial elections, retired to his berth on a train en route to Toronto and was found dead in the morning. A heart attack was responsible for his death. A prime mover in the establishment of the pulp and paper industry in Fort William, first the Fort William Paper Co. and later the Great Lakes Paper Co., Mr. Murphy was enroute to Toronto and New York in connection with plans for another mill at Fort William when his death occurred. He was a former mayor of Fort William.

George Riker

CAMBRIDGE, Mass., October 18—George Riker, assistant superintendent at the Middlesex Products Company, manufacturers of box coverings, recently died suddenly. Mr. Riker came to the company as a young man in 1901 to take a position as chemist.

Indianapolis Reports Firm Undertone

[FROM OUR REGULAR CORRESPONDENT]

INDIANAPOLIS, Ind., October 25, 1937—While reports as to activity in the paper trade field in this section are somewhat contradictory, it is safe to say that business volume is not as large as had been expected during the last of October. Even so, there is a firm undertone to the market and few executives can be found who feel that another depression or recession in business is on its way. Prices in virtually all items are well held and many feel that volume is down because of the lateness of the fall season.

One of the rather bright spots in demand comes from the newsprint field where demand continues active and the volume of contract shipments is normal. Newspapers in the rural fields continue to be very active buyers and with the change in seasons, lineage in the metropolitan centers has increased. Prices are firm with no changes indicated.

The fine paper situation is only fair. Demand for books, covers and ledgers is not as large as was expected, but prices are firmly held. Some printers report a few contracts being closed for catalogue and other direct mail literature.

In all lines it is reported that credit conditions are about the best since 1929. The financial situation in virtually all retail outlets is good, according to local jobbers and the old days of C.O.D. deliveries has about passed.

Container demand is none too heavy, according to local manufacturers, but some merchandise is being made up for the holiday trade and this volume is expected to be at least as good as it was a year ago. Textiles, hardware and automobile accessory plants continue to be active purchasers.

A rather steady demand continues for paper stock, with rags rather less popular. Paying prices show no change from the week before, which paper stock men say already are too low.

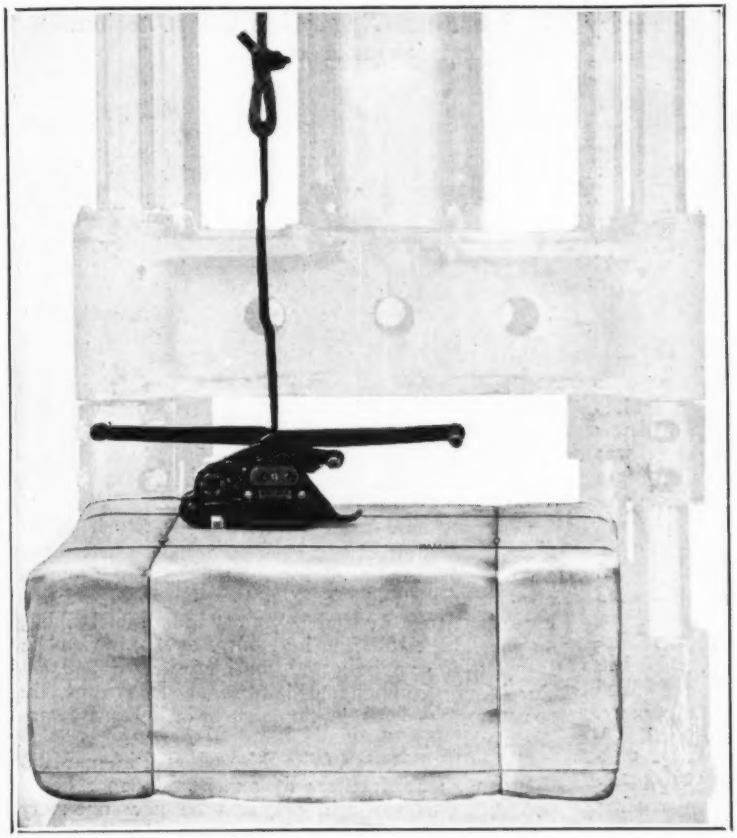
Temperature Control and Recording

A new catalogue, No. 1102, issued by the Brown Instrument Company of Philadelphia, Pa., illustrates and describes the complete line of the company's potentiometer pyrometers, which operate as indicating, recording and controlling instruments. The new electr-o-line controllers and the Brown proportioning system are included. The potentiometer recorders are furnished with three forms; continuous ink, colored dot-circles and colored numeral records. A copy of the catalogue will be sent upon request.

at HOUSTON

in the new mill of the **CHAMPION PAPER & FIBRE CO.**

CHAMPION PULP BALES



are

GRIPLOCK

STRAPPED

Because

CHAMPION DEMANDS

- Maximum protection for its pulp bales in transit.
- Maximum speed in its pulp baling operation.
- Maximum efficiency and economy.

C. TENNANT, SONS & CO.

of New York

9 Rockefeller Plaza New York City

Seattle, Wash. Toronto, Can.

GRIPLOCK

WIRE STRAPPING *for* BALING PULP

CONSTRUCTION NEWS

A Summary of Vital Facts Regarding Construction, of Pulp and Paper Mills

General Construction News

Kansas City, Mo.—The Industrial Paper Stock Company, 136 Main street, commercial paper stocks, wrapping papers, etc., has approved plans for one-story addition to storage and distributing plant. General contract has been awarded to F. A. Taylor, 1002 Walnut street, Kansas City, and work is scheduled to begin at once. It is reported to cost close to $25,000, including equipment.

St. Louis, Mo.—The Keasbey & Mattison Company, Ambler, Pa., manufacturer of asbestos mill board products, asbestos paper goods, etc., has awarded a number of contracts for proposed new mill at St. Louis, where tract of land recently was selected, as previously noted in these columns. Main unit will be one-story, 120 x 675 feet, and supplemented by a number of smaller structures. General erection contract will be carried out by the United Engineers & Constructors, Inc., 1401 Arch street, Philadelphia, Pa. Award for excavations has been made to Frank Weber, Jr., 5906 McPherson street, St. Louis; for structural steel framing to the Mississippi Valley Structural Steel Company, 3117 Big Bend road, St. Louis; and for steel sash and allied specialties, to the Ceco Steel Products Company, 1926 South 52nd avenue, Cicero, Chicago, Ill. A railroad siding to plant site will be constructed by Longwill-Scott, Inc., St. Louis. Bids are now being asked for heating and plumbing installation, roofing and flashing, and other features of work. Entire project is estimated to cost close to $500,000. Work will be placed under way at once, with completion scheduled early next year.

New York, N. Y.—The Ritz Paper Box Company, Inc., recently organized, is said to be planning early operation of local plant for the manufacture of a line of folding paper boxes and containers. New company is represented by Irving R. Sugarman, 63 Park Row, New York, attorney.

Bogalusa, La.—The Gaylord Container Corporation, 2820 South Eleventh street, St. Louis, manufacturer of corrugated paper boxes and containers, operating the Bogalusa Paper Company, Inc., Bogalusa, is planning early construction of a one-story addition in vicinity of pulp mill of latter company for a new by-products plant, for the manufacture of soap specialties from liquors secured through pulp mill operation. It is reported to cost over $60,000, including equipment. As recently noted in these columns, an expansion program is under way at the Bogalusa mill, to provide for increased production in a number of divisions, estimated to cost close to $400,000, including machinery.

Baltimore, Md.—The building at 314-16 South Hanover street, occupied in part by the Gordon-Lavin Paper Box Company, manufacturer of folding paper boxes and containers, was damaged recently by fire. An official estimate of loss has not been announced. It is proposed to rebuild. This company, as lately reported in these columns, has plans maturing for new two-story and basement plant unit, estimated to cost approximately $40,000, with equipment.

Cincinnati, Ohio—The Rainbow Lithographing Company, 4142 Davis lane, manufacturer of paper products, paper boxes, etc., has plans nearing completion and will take bids soon on general contract for new three-story and basement addition, 40 x 90 feet, estimated to cost over $60,000, including equipment. Frankenberger & Batson, 4122 Davis lane, are architects and engineers in charge.

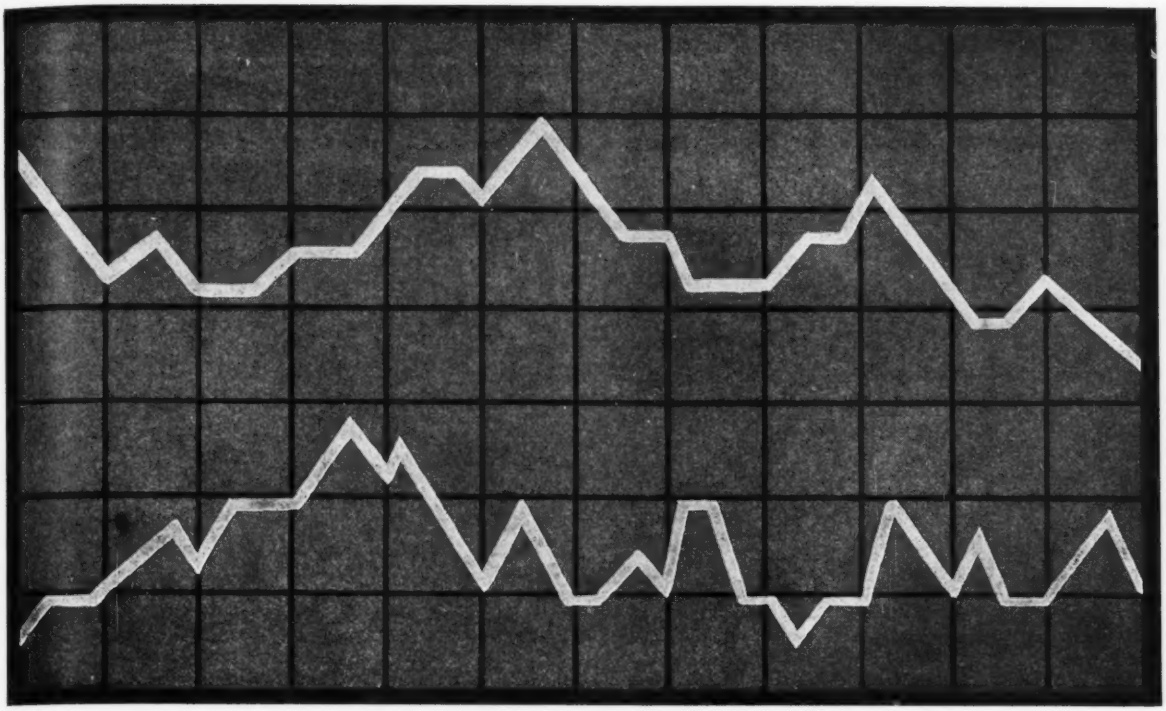
Chicago, Ill.—The Lissner Paper Stock Company, Leavitt street and Wilmot avenue, waste paper products, has arranged for the purchase of property now occupied under lease at location noted, consisting of a two-story and basement industrial building on site, 118 x 152 feet, heretofore owned by Isadore Doppelt, for an indicated consideration of $40,000. Purchasing company will continue to occupy the structure and plans development in business. Edward Lissner is president.

Rothschild, Wis.—The Marathon Paper Mills Company, manufacturer of paper and paper board products, has work in progress on new one-story addition, 60 x 125 feet, for which general contract was awarded recently to the Permanent Construction Company, 735 North Water street, Milwaukee, Wis. It is reported to cost over $40,000, and will be used primarily for storage and distributing service.

Chicago Heights, Ill.—The Gold Seal Asphalt Roofing Company, 50 Lowry avenue, North, Minneapolis, Minn., manufacturer of composition paper and asphalt roll roofing, will soon begin erection of new plant on State street, near city limits, Chicago Heights, consisting of a group of five one-story units, estimated to cost close to $200,000, with equipment. Award for buildings has been made to the Blaw-Knox Company, Blawnox, Pittsburgh, Pa.

Brighton, Mass.—The Thompson & Norris Division of Hinde & Dauch Paper Company, 119 Braintree street, Brighton, Boston, manufacturer of corrugated paper boxes and containers, is considering rebuilding of storage and distributing warehouse at local plant, recently destroyed by fire, with loss estimated close to $100,000, including building, equipment and stock. Main offices of parent company are at Sandusky, Ohio.

Enka, N. C.—The American Enka Corporation,



DANGEROUS CURVES

When the temperature curve of your dryer section wanders aimlessly over the graph, watch out!

- Such a curve means that air and condensate are present, isolating the steam from the dryer shell . . . forcing the use of higher steam pressures to dry the sheet.
- Such a curve means loss of control over your drying conditions . . . inability to gradually increase the temperature starting with the wet-end dryers . . . one of the fundamentals of scientific moisture removal.
- Such a curve means a retarded temperature response to your dryer when, due to a change of run, you may want to obtain a quick rise or drop in dryer temperature. Broke and more broke!
- Such a curve means under-drying on some dryers, excessive-drying on others . . . the very conditions that produce curling, cockling, broke and other troubles.

On 500 machines the above troubles have been eliminated by installing Fulton Dryer Drainage systems. Consider what such a proven system will mean on *your* machine. Ask for Bulletin No. 40 if operating dryers at pressures of 5 to 50 pounds; Bulletin No. 60 if operating at lower pressures.

THE MIDWEST-FULTON MACHINE CO.
Dayton, Ohio

MIDWEST-FULTON

Enka, near Asheville, manufacturer of cellulose rayon products, has work nearing completion on an expansion and improvement program at mill, under way for a number of months past, previously referred to in these columns. About 100,000 square feet of floor space has been added to the plant, with installation of equipment in various buildings for large increased capacity. Work is now in progress on the final structure of the expansion project, a one-story building for storage and distribution, for which general contract recently was let to Potter & Shackleford, Greenville, S. C., to cost about $60,000, with equipment. The power plant at mill has been enlarged and additional equipment installed. Entire project represents an investment of close to $1,000,000.

Brooklyn, N. Y.—The Standard Fibre Specialty Corporation, 18 West 20th street, New York, manufacturer of fiber products, has leased a two-story building at 92 Bogart street, owned by the Detroit Furniture Company. Structure totals about 15,000 square feet of floor space and will be occupied by first noted company for expansion. Building will be remodeled and improved, and equipment installed at early date. The lease is for a five-year period.

Port Edwards, Wis.—The Nekoosa-Edwards Paper Company, Inc., manufacturer of waxed and other processed paper stocks, wrapping papers, etc., has superstructure under way for new two-story addition to mill, 40 x 40 feet, recently referred to in these columns, and will push work to early completion. It will be used for extensions in the bleach department, and is reported to cost approximately $65,000, with equipment.

Pine Bluff, Ark.—The Arkansas Power and Light Company, Pine Bluff, through its president, Harvey C. Couch, reports that a company, name temporarily withheld, is considering the constructure of a new plant about 150 miles from Little Rock, Ark., for the production of salt cake for paper manufacturing service. It is said that the plant will be associated with paper mills in the State, as well as other points in the South, including Louisiana. The proposed plant will comprise several large units and will cost close to $1,500,000, including development of sulphate rock properties in vicinity of mill site for raw material supply.

Wilmington, N. C.—The Riegel Paper Corporation, 342 Madison avenue, New York, N. Y., manufacturer of waxed glassine, greaseproof and other paper stocks, is arranging with the Atlantic Coast Line Railway for the construction of a spur line track from point near Acme, N. C., to site of new pulp mill of company, vicinity of Wilmington, where company recently acquired a large tract of land. Plans for initial mill units are in progress and it is said that bids will be asked on general erection contract in near future. New mill will be equipped for a capacity of about 125 tons of sulphite pulp per day and will have facilities for the employment of close to 800 persons in different departments. It is estimated to cost close to $3,000,000, with machinery. J. E. Sirrine & Co., Greenville, S. C., are consulting engineers.

Kenora, Ont.—The English River Pulp Company, Toronto, Ont., care of McMaster, Montgomery, Fleury & Company, Temple Building, attorneys and representatives, recently organized by American paper mill interests, has preliminary plans under way for a new sulphite pulp mill on site in vicinity of Kenora, now being selected. It will consist of several one and multi-story units, equipped for large capacity, with power house, pumping station, machine shop and other structures, estimated to cost close to $5,000,000, including machinery. It is proposed to begin work early in 1938.

Sault Ste. Marie, Ont.—The Soo Pulp Products, Ltd., Toronto, Ont., recently organized, care of Smith, Rae, Greer & Cartwright, 371 Bay street, Toronto, attorneys and representatives, is selecting a site on Lake Superior, in vicinity of Sault Ste. Marie, for a new sulphite pulp mill, for which plans will be prepared in near future. It will comprise a large group of one and multi-story structures, equipped for a capacity of about 300 tons per day, with power house, pumping station and other mechanical units. Entire project is estimated to cost in excess of $4,000,000. G. C. Schneider, Room 616, 310 South Michigan avenue, Chicago, Ill., is interested in the new company.

Canadian Mills To Limit Output

[FROM OUR REGULAR CORRESPONDENT]

TORONTO, Ont., October 25, 1937—With the paper mills applying the brakes and some of the Canadian plants shutting down to a 5-day week until the available supplies are reduced, an interesting situation is revealed in the newsprint industry in the Dominion. Further, it is believed that other manufacturers of newsprint in Canada will decide to adopt the same policy and that before the end of the month the whole Canadian industry will be operating on a 5-day week. The reason for this step is said to be that the industry faces an over-expansion of production which, at this time, would be highly detrimental to the larger plants of putting operations on a more profitable basis.

The possibility of over-production has caused some surprise in newsprint circles, for the available statistics did not disclose the fact that Canadian manufacturers have large stocks of paper in United States warehouses and that the supply of newsprint paper on this continent is considerably larger than is known. It is pointed out that a curtailment of production at this time is essential in order to preserve a more serious situation later on. A slowing down of operations represents a radical departure from the policy followed to date. Hitherto the mills have been operating at capacity in order to meet the demand for newsprint paper from United States publishers. Production and consumption have been at a record level for months past and all indices have been highly favorably as regards the outlook for the industry. It is stated now that production of newsprint in Canada during the last quarter of 1937 will fall below that for the corresponding period of 1936.

Condor Compensated Belts

The Manhattan Rubber Manufacturing Division of Raybestos-Manhattan, Inc., Passaic, N. J., has just issued a new illustrated four-page bulletin on its Condor Compensated Belts. In addition to describing the reason for compensating rubber belts and the Compensated Principle, the new folder explains in detail the advantages of this type of belt. Engineering data essential to the proper selection, application and supervision of belts is also included.

• HAMMERING OUT NEW MARKETS

NEW markets await the paper manufacturer who strengthens his selling technique with sound production methods. Cyanamid offers you cooperation in keeping your production methods on a permanently efficient basis—with a comprehensive variety of paper chemicals, an experienced technical staff to service them, and extensive research facilities.

DEPEND ON CYANAMID FOR:

ALWAX SIZE
WAXINE SIZE
ROSIN SIZE
Dry or Liquid
TAPIOCA & SAGO FLOUR
ALUMINUM SULPHATE 17%
Commercial and Iron Free
CASEIN
CHINA CLAY
SATIN WHITE
BLANC FIXE
SULPHONATED OILS
DEFOAMERS
WETTING AGENTS
SALT CAKE
CAUSTIC SODA
SODA ASH
ACIDS
Muriatic, Nitric, Sulphuric

AMERICAN CYANAMID & CHEMICAL CORPORATION

30 ROCKEFELLER PLAZA • NEW YORK, N. Y.

Boston Philadelphia Baltimore Charlotte, N. C. Chicago Cleveland Kalamazoo

PAPER TRADE
ESTABLISHED 1872
JOURNAL

Reg. U. S. Pat. Off.

George S. Macdonald, Pres. *Joseph P. Horgan, Secy.*
Executive and Editorial Offices, 15 West 47th St., New York, N. Y.

Henry J. Berger
EDITOR

Ronald G. Macdonald
Editor Technical Section

Lynne M. Lamm
Washington Correspondent

Price, Per Copy, 10 Cents — United States, Per Annum, $4.00
Canada and Foreign Countries in Postal Union, $6.00

Member Audit Bureau of Circulations

Vol. CV New York, October 28, 1937 No. 18

COMING EVENTS IN THE PAPER INDUSTRY

NEW ENGLAND SECTION, Technical Association of the Pulp and Paper Industry—Third Friday of each month at the Nonotuck Hotel, Holyoke, Mass.

DELAWARE VALLEY SECTION, Technical Association of the Pulp and Paper Industry—Second Friday of each month at the Engineers Club, Philadelphia, Pa.

LAKE STATES SECTION, Technical Association of the Pulp and Paper Industry—Second Tuesday of each month at the Conway Hotel, Appleton, Wis.

KALAMAZOO VALLEY SECTION, Technical Association of the Pulp and Paper Industry—First Thursday of each month at the Park-American Hotel, Kalamazoo, Mich.

TAPPI IN THE SOUTH

The annual fall meeting of the Technical Association of the Pulp and Paper Industry at Savannah, Ga., last week was the largest fall meeting ever held in the history of the association, and the meeting was unusually successful in many other respects as well.

This is the second time TAPPI has met in the South. The previous occasion was in 1929 when the association met at Richmond, Va. This meeting, although considered decidedly successful at the time, was only about half as numerously attended as the meeting held last week. Dr. Herty at this time had not as yet begun his splendid work in publicising the natural resources of the South for paper making purposes.

The choice of Savannah and the very great success of the recent convention is not difficult to understand. It is accounted for, of course, in very large measure by the almost magical increase in imporance of the South as a pulp and paper manufacturing center. Savannah not only is the city in which the first of the great new Southern mills was erected, but it also is the most convenient point from which many of the new plants just completed or in the process of erection, may be reached.

So the invitation from TAPPI to come to Savannah this fall proved an attractive one to the technical men of the pulp and paper industry, not only in this country, but in Canada and even in some more remote parts of the world, making it a truly international meeting of the men interested more especially in the technical side of the paper business.

It is safe to say that what the visiting TAPPI members saw and heard made the trip worthwhile and that because of their visit they will undoubtedly follow with greater interest than ever the new and increasingly important place that the South is destined to occupy in the pulp and paper industry.

LABOR BOARD RULINGS

One of the disturbing factors in industry is the enforcement of the Labor Relations Act. While this law has been stated to be less effective than its sponsors had desired, recent decisions of the Labor Board have shown that severe penalties are being imposed. The majority of the cases brought before the Board are concerned with the illegal discharge of employees. If it is found that workers have been fired through union activity, the Board has usually ordered their reinstatement, with the payment of back wages. In some instances, back wages for a period of two years have been ordered paid.

A case in point, is given by the Chamber of Commerce of the United States, which stated: "The Board ordered a manufacturer to reinstate three employees who had been laid off in June 1935, prior to the passage of the Labor Relations Act, and to pay them amounts equivalent to their full wages from the time of loss of employment to the date of offer of reinstatement, less any amount earned by them during the interval of more than two years.

"In this case the Board held that these three employees had been laid off, among others, during a seasonal shutdown but were not actually discharged until some days later when the Labor Relations Act had become effective. The Board ruled they had been illegally discharged for union 'affiliation, activities and associations.'

"At the same time, the Board ordered the manufacturer to offer all employees who had participated in a strike beginning in August 1935, immediate and full reinstatement to their former positions. The order stipulated that such of those persons for whom employment was not at once available, should be placed on a preferred list to be offered employment as it arises on the basis of seniority, before any other persons are hired. In the event of the refusal to reinstate where suitable work was available, the Board ruled, the employer must pay to each person concerned, a sum equal to that which would be normally earned as wages during the period from the date of the refusal to reinstate to the date of reemployment."

In another decision made public during the current month, the Chamber of Commerce stated: "The Board, by implication at least, seemed to recognize the right of an employer to refuse to bargain with a labor organization in the absence of conclusive proof

that it was designated to represent a majority of the employees in an appropriate unit. This decision, handed down in a recent case, would appear to indicate that even though an employer is not permitted under the Board's regulations to ask for an election, the Board may consider an employer justified in declining to negotiate an agreement with a union pending Board certification that it is entitled to represent a majority.

"The Board's ruling took the form of an order having the effect of invalidating a closed shop agreement with an employees' association which, according to the Board's findings, did not represent a majority of the employees at the time the agreement was made. The Board also ordered the employer to cease and desist 'from bargaining collectively with any labor organization unless and until such labor organization has been selected in an election conducted by the National Labor Relations Board as the bargaining agency of the employees.'"

In commenting on recent election cases the Chamber of Commerce states: "The Board still interprets the statute as enabling it to designate as the exclusive representative for bargaining purposes, an organization selected by a majority of the employees voting in an election, even though the ones voting for the organization constitute a minority of the total number of employees in the unit concerned."

Logan Paper Co. Vacates Canal

DAYTON, Ohio, October 22, 1937—Another step in proposed plans for the construction of a highway through this city was taken by city council last night when formal vacation of the canal by the Logan Paper Company was accepted. The company has used the canal for several years as a source of water in the manufacture of roofing paper.

The water was diverted last week through the Fourth street sewer and the company started pumping its water from the Miami river.

The Logan Long Company has paid the city a monthly rental fee for use of the canal.

Efforts will be made by the city to obtain a grant of federal funds for the construction of a highway to divert Route 25 traffic from Center street.

West Virginia Gets $25,000 Refund

WASHINGTON, D. C., October 27, 1937—The Bureau of Internal Revenue has announced that a refund of $25,000 has been made to the West Virginia Pulp and Paper Company, New York City.

In announcing the refund the Bureau says that "the certificate of overassessment is issued pursuant to directions contained in a letter from the Department of Justice. Under these directions payment of the sum mentioned herein is made in full settlement of all issues involved in the case of the West Virginia Pulp and Paper Company v. Bowers, now pending in the United States District Court for the Southern District of New York, and dismissal of said suit with prejudice is to be entered."

Production Ratio Report

These statistics are based upon paper production reports to the American Paper and Pulp Association.

COMPARATIVE MONTHLY SUMMARIES

Months	1937	1936	1935	1934
January	90.3% (c)	76.1%	65.8%	.....
February	90.1% (c)	77.9%	70.0%	.....
March	90.3% (c)	76.0%	70.5%	.....
April	92.1% (c)	82.3%	70.0%	.....
May	90.6% (c)	81.6%	69.4%	.....
June	87.3% (c)	80.7%	72.3%	.....
July	81.8% (c)	77.3%	64.9%	.....
August	82.9% (c)	81.5%	70.9%	.....
September	78.7% (c)	80.5%	71.9%	58.2%
October	.....	87.6%	75.6%	64.7%
November	.....	88.0%	75.3%	61.7%
December	.....	85.9%	71.2%	59.6%
Year-Average	.....	81.3%	70.5%	.....
Year to date, first 41 weeks	86.4%	79.6%	69.7%	.....

COMPARATIVE WEEKLY SUMMARIES

Current Weeks, 1937		Corresponding Weeks, 1936	
*September 11	68.7% (h)	September 12	71.2% (h)
*September 18	82.7%	September 19	85.7%
*September 25	82.0%	September 26	84.3%
*October 2	79.3%	October 3	85.3%
*October 9	76.7%	October 10	87.1%
*October 16	71.4%	October 17	87.6%

The following statistics show the number of mills reporting by ratio groups:

NUMBER OF MILLS REPORTING, CURRENT WEEKS

Ratio Limits	Sept. 11 1937	Sept. 18 1937	Sept. 25 1937	Oct. 2 1937	Oct. 9 1937	Oct. 16 1937
0% to 50%	107	85	82	86	91	88
51% to 100%	211	228	228	225	213	133
Total Mills Reporting	318	313	310	311	304	221

* Subject to revision until all reports are received.
(c) Basic capacity data have been adjusted to correspond with ratings reported by individual companies.

PAPERBOARD OPERATING RATIOS

According to reports from the National Paperboard Association, per cents of operation, based on "Inch-Hours," were as follows:

Mos.	1937	1936	1935	1934	Mos.	1937	1936	1935	1934
Jan.	80% (e)	61%	61%	....	July	67% (e)	69%	59%	....
Feb.	86% (e)	67%	67%	....	Aug.	74% (e)	75%	65%	....
Mar.	87% (e)	68%	67%	....	Sept.	....	76%	69%	62%
April	89% (e)	70%	61%	....	Oct.	....	82%	76%	63%
May	86% (e)	68%	61%	....	Nov.	....	79%	70%	56%
June	75% (e)	68%	65%	....	Dec.	....	74%	60%	52%

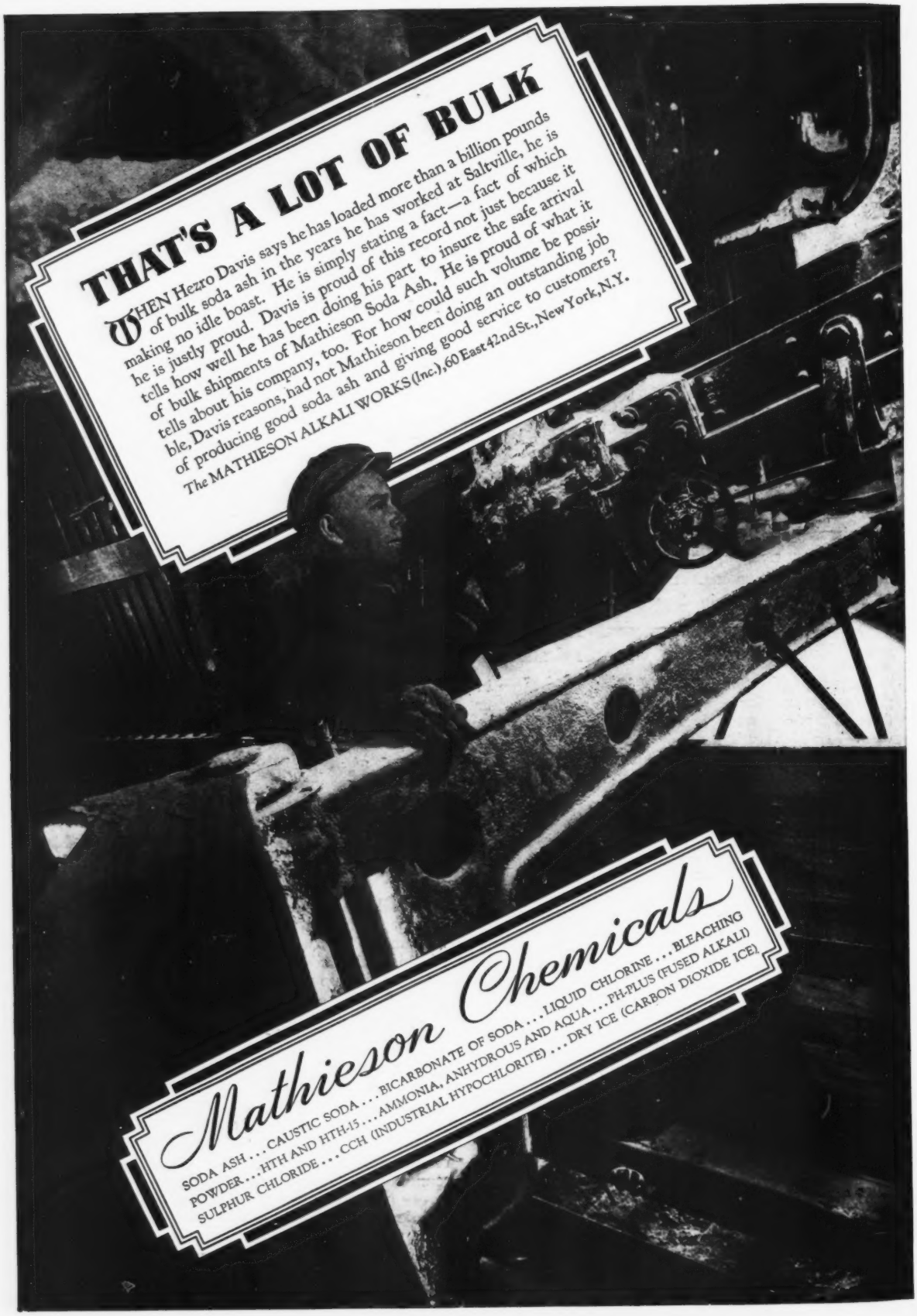
Week end. Sept. 11, 1937 59% (h) Week end. Oct. 2, 1937... 71%
Week end. Sept. 18, 1937 73% Week end. Oct. 9, 1937... 67%
Week end. Sept. 25, 1937 70% Week end. Oct. 16, 1937... 68%

(e) Basic figures revised to include new members of the National Paperboard Assn.
(h) Holiday week; percentages based on six days' operation.

Hubbs Paper Houses Meet in Buffalo

At a general meeting of salesmen and executives held in Buffalo recently, the Hubbs chain of wholesale paper houses worked out a plan to carry out the aims of the founders and perpetuate the traditions of this old established group of merchants. The units making up the chain are: C. F. Hubbs & Company of New York City, Hubbs & Corning Company of Baltimore, Interstate Cordage and Paper Company of Pittsburgh, Hubbs & Hastings Company of Rochester, Hubbs and Howe Company of Buffalo and Cleveland, Victoria Paper and Twine Company of Toronto and Montreal.

The two-day meeting was devoted to a thorough discussion of possibilities for closer cooperation between the units. Interesting talks were made by representatives of each house and a prominent executive connected with one of the leading kraft mills made a very interesting and instructive address on the new mill developments in the South. Arrangements were made whereby these sales conferences will be scheduled at regular intervals, alternating at each of the houses.


THAT'S A LOT OF BULK
WHEN Hezro Davis says he has loaded more than a billion pounds of bulk soda ash in the years he has worked at Saltville, he is making no idle boast. He is simply stating a fact—a fact of which he is justly proud. Davis is proud of this record not just because it tells how well he has been doing his part to insure the safe arrival of bulk shipments of Mathieson Soda Ash. He is proud of what it tells about his company, too. For how could such volume be possible, Davis reasons, had not Mathieson been doing an outstanding job of producing good soda ash and giving good service to customers?
The MATHIESON ALKALI WORKS (Inc.), 60 East 42nd St., New York, N.Y.
Mathieson Chemicals
SODA ASH . . . CAUSTIC SODA . . . BICARBONATE OF SODA . . . LIQUID CHLORINE . . . BLEACHING POWDER . . . HTH AND HTH-15 . . . AMMONIA, ANHYDROUS AND AQUA . . . PH-PLUS (FUSED ALKALI) SULPHUR CHLORIDE . . . CCH (INDUSTRIAL HYTOCHLORITE) . . . DRY ICE (CARBON DIOXIDE ICE)

Section of the
Technical Association of the Pulp and Paper Industry

Edited by Ronald G. Macdonald, Secretary

The Forest Situation in the Lower South*

By I. F. Eldredge[1]

Abstract

A review of the survey recently made by the Southern Forest Experiment Station of the timber resources of the South for sawtimber, naval stores and pulpwood uses. The need for sound forest management policies is pointed out to indicate what needs to be done to perpetuate the forests and the industries that they serve.

During the last five years, by direction of Congress, the U. S. Forest Service has been making an inventory of the growing stock of timber in the main forest regions throughout the United States. The survey of the South's forest resource got underway in 1932 with a system based largely on the methods used successfully about ten years ago in the national forest surveys of Finland and Sweden. Our method involves running parallel compass-lines across the country at ten-mile intervals and on these lines taking quarter-acre sample plots every 660 feet. On the sample plots our timber cruisers count, measure, classify, grade, and take the heights and the volumes of the trees found. We ascertain their rate of growth, their age, their form and the amount of cull and its cause. In addition, the amount and character of the reproduction, the presence or absence of fire damage, the degree and character of erosion, and

* Presented at the Fall Meeting of the Technical Association of the Pulp and Paper Industry, DeSoto Hotel, Savannah, Ga., Oct. 18-21, 1937.

[1] Regional Survey Director, U. S. Forest Survey, Southern Forest Experiment Station, New Orleans, La.

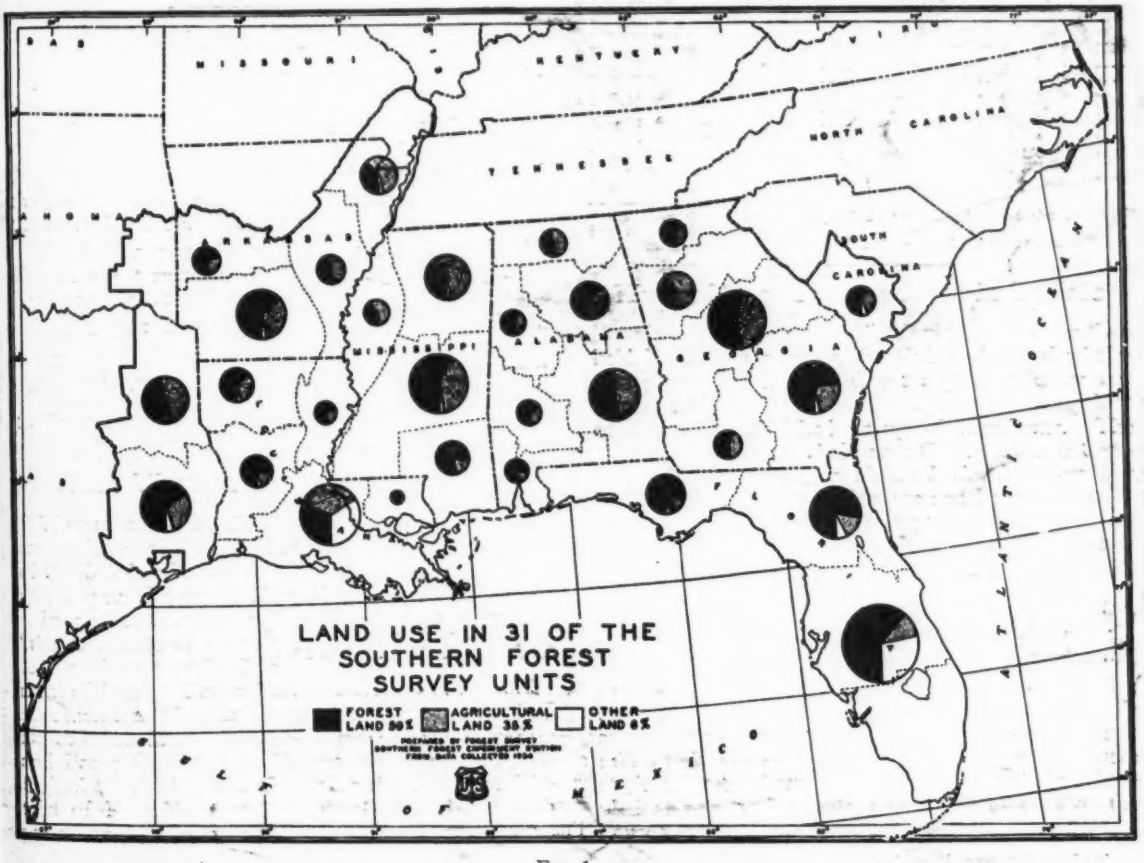


FIG. 1.

many other pertinent facts are recorded. The several hundred thousand sample plots systematically taken and uniformly and precisely measured give us a sound basis for an extensive appraisal of the extent, the character, and the volume of our timber stands, the rate at which these stands are increasing through growth, and the rate at which they are being reduced by natural mortality and the ravages of fire, storm, insects, and rot. Independently of the line-plot survey, we have made a careful economic study of the drain against the forest growing stock occasioned by utilization for lumber, poles and piles, ties, cooperage stock, pulpwood, fuel, and other purposes.

The field work of the survey in the lower south, except for the post oak country of Texas and Oklahoma, was finished a little over a year ago; but the larger and much more time-consuming job of converting the field data into usable information for publication and its integration in a thorough-going economic study of the situation is still underway. The compilation of the field data and analysis of the resulting figures have, however, progressed to a point where the data are rapidly becoming available for the greater part of the southern survey area. North of our territory, in the Appalachian Region, the survey field work has been completed in South Carolina and is well underway in North Carolina.

One of the outstanding features of our finding is the large proportion of the land surface that is in timber growth. Fig. 1 shows a summary of land use in the lower south as found by the forest survey. The area surveyed was divided into survey units, whose boundaries are shown. In each of these units is a circle whose size is proportional to the land area of the unit in which it occurs. The black portion of each circle represents the forest area in the given unit; the gray portion represents the area in agriculture; and the white represents the land in other uses.

Of the 31 survey units shown, 22 have from half to more than 4/5 of their land area in forest growth; and 8 of the 9 remaining units are nearly half forest. The Everglades in south Florida and large areas of marshland in south Louisiana are chiefly responsible for the large proportion of white in the circles representing these units.

The proportion of forest land is greatest in the survey units bordering the Atlantic and Gulf Coasts and in several of the units lying west of the Mississippi.

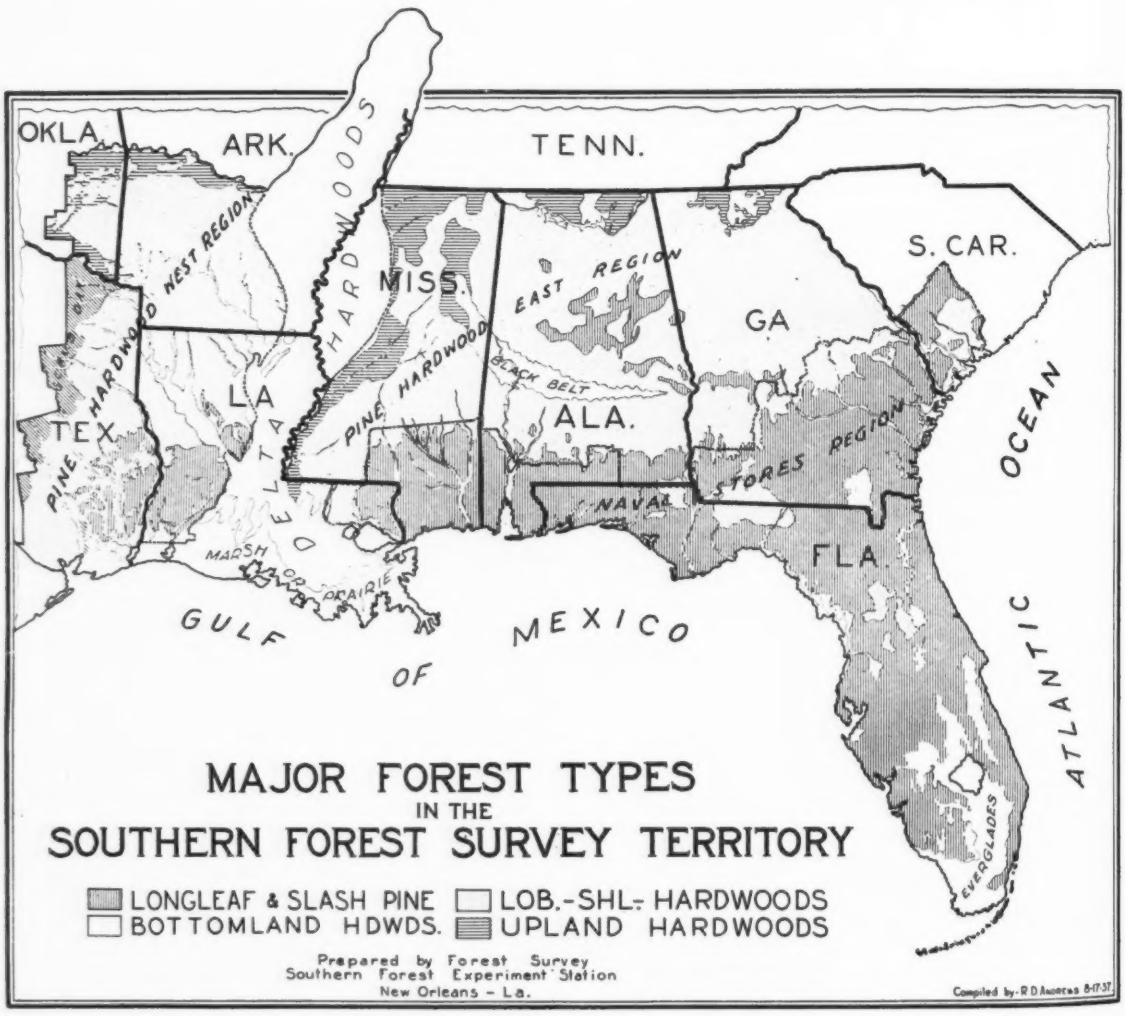


FIG. 2.

Considering the lower south as a whole, forest growth in some stage occupies 59 per cent of the land area, only 35 per cent is used for agriculture, and 6 per cent is in other uses.

Major Type Regions

There are four major type regions in the lower south as shown in Fig. 2. In a great broad belt bordering the Atlantic and Gulf Coasts from North Carolina to Texas, but jumping the Mississippi delta, the forests are predominately of longleaf or slash pine, more or less intermixed on certain sites with loblolly and other pines, with hardwoods and cypress in the stream bottoms, swamps, and ponds. For over two centuries these forests have been the source of from 60 to 80 per cent of the world's naval stores—turpentine, rosin, and pitch. Longleaf pine also characterizes the forests of a rather large area in north central Alabama. In the interior and to the north of the coastal belt of longleaf and slash pine, the forests are predominately of loblolly and shortleaf pine more or less intermixed with hardwoods. In a few sections, as in west central and north Mississippi, north Alabama, and north Georgia, the predominating tree species are upland or mountain hardwoods.

Separating the eastern and western portions of the southern uplands are the bottomlands of the main Mississippi River system, a belt ranging from 40 to more than 100 miles wide, in which the forests are almost entirely of bottomland hardwoods. While the forests of the delta constitute the largest single body of hardwoods in the south—and probably in the whole United States as well—they are more or less duplicated on a smaller scale along each of the larger rivers emptying into the Gulf and the Atlantic, and in the aggregate these lesser bottomland hardwood areas equal or exceed the Delta region in both area and volume of hardwood timber.

For the purposes of description the lower south has been divided into four major forest regions as shown by the broken lines on the map: the naval stores, pine-hardwood east, pine-hardwood west, and delta hardwood regions.

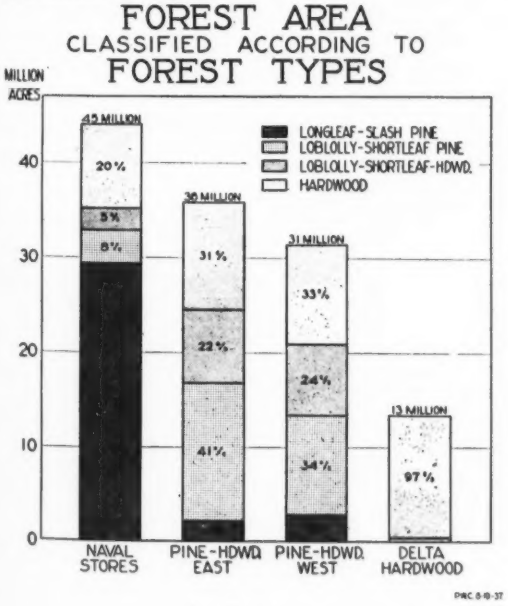


Fig. 3.

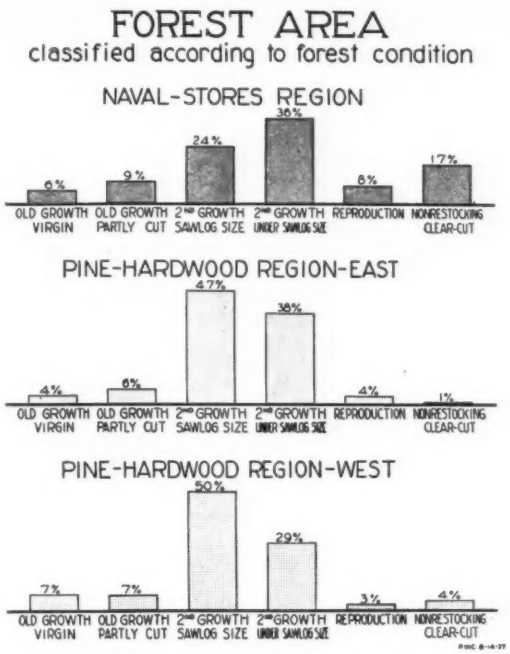


Fig. 4.

In Fig. 3 the forest area of the four major regions outlined above is compared and the acreage of the principal forest-types within them is shown. The naval stores region has by far the largest forest area, that is, 45 million acres; whereas, although the pine-hardwood region (east) has a greater total area, it has only 36 million acres of forest; next is the pine-hardwood region (west) with 31 million acres of forest; while the delta hardwood region has the smallest forest area, 13 million acres.

In the naval stores region, longleaf and slash pine types occupy two-thirds of the forest area, or 29 million acres; loblolly and shortleaf pine and loblolly-shortleaf-hardwood types together occupy 6 million acres, and practically "pure" hardwood and cypress types occupy 9 million acres. In the pine-hardwood east, loblolly-shortleaf and loblolly-shortleaf-hardwoods together occupy slightly less than two-thirds of the forest area of the region, or 22 million acres; longleaf and slash pine types occupy only 6 per cent; and hardwoods occupy 11 million acres, or 31 per cent of the forest area. Similarly, in the pine-hardwood west, loblolly-shortleaf and loblolly-shortleaf-hardwoods together occupy 58 per cent of the forest area of the region, or 18 million acres; hardwoods occupy 33 per cent, or 10 million acres; and longleaf pine types occupy 3 million acres, or 9 per cent of the forest area. (Slash pine does not occur naturally west of the Mississippi River.) In the Delta hardwood region, practically "pure" hardwood or cypress types occupy 97 per cent of the forest area, and pines characterize only 3 per cent, chiefly in areas adjacent to neighboring pine or pine-hardwood units.

Because of the small amount of pine in the Delta and because from a pulpwood standpoint we are at present interested principally in pine, I shall confine the remainder of my talk to the three pine regions, namely, the naval stores, pine-hardwood east, and pine-hardwood west.

Condition of Timber

The survey classified timberland as either old growth, second growth, reproduction, or clear-cut and further subdivided some of these conditions. In Fig. 4 the forest area of the three pine regions is classified according to forest condition. In all three regions, second-growth stands occupy by far a greater part of the forest area—89 per cent in the pine-hardwood east, 82 per cent in the pine-hardwood west, and 68 per cent in the naval stores region. Remnants of the original old-growth forest occupy but a comparatively small part—15 per cent in the naval stores region, 14 per cent in the pine-hardwood west, and 10 per cent in the pine-hardwood east—of which somewhat less than half consists of uncut (virgin) stands. It is interesting to note that although approximately 95 per cent of the forest land in each of these regions has been worked over for forest products from one to several times, the amount of land that has failed to restock after clear cutting is surprisingly small. The greater proportion of unrestocked clear-cut area is found in the naval stores region and the longleaf pine belt of the southwest, where skidder logging and frequent fires account for a considerable area of denuded pine land, much of which has come back to worthless scrub hardwoods.

Fig. 5 shows the forest growing stock in the three pine regions. The estimate includes only sound live trees of 5 inches d.b.h. and up. In the three regions combined, the stand of good trees totals 540 million cords of pine and 450 million cords of hardwoods and cypress. Of the pine, 170 million cords are in the naval stores region, 190 million cords in the pine-hardwood east, and 180 million cords in the pine-hardwood west. In all three, approximately two-thirds of the pine volume is in trees under 13 inches. Although the pine is receiving the greatest attention from a pulpwood standpoint, it should be borne in mind that approximately half of the hardwood volume is in species that are suitable for pulping.

Considering all forest conditions in the pine types only, the average stand of pine per acre is 4.7 cords

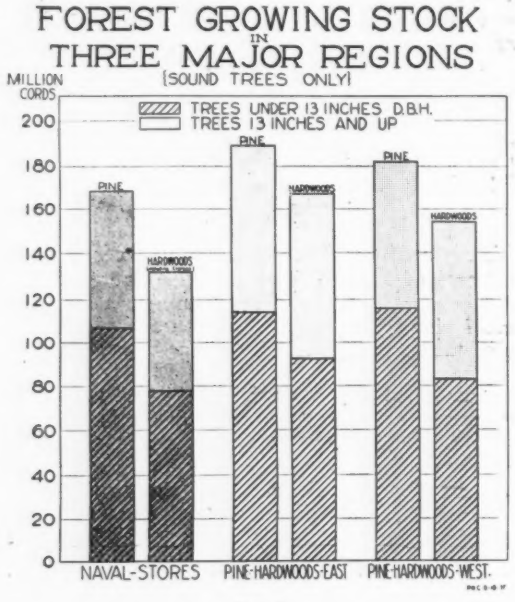


Fig. 5.

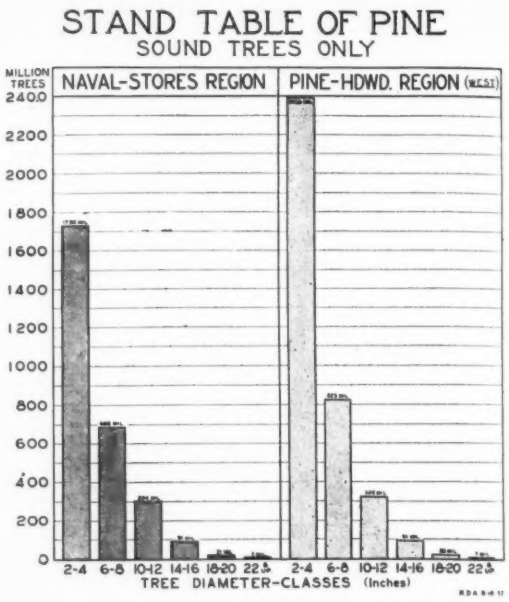


Fig. 6.

in the naval stores region, 7.7 cords in the pine-hardwood east and 8.5 cords in the pine-hardwood west.

In all three regions, from a forest management standpoint, a considerable portion of the volume in trees under 13 inches could advantageously be removed in thinning over dense stands and utilized for pulpwood; and the top stems of trees cut for sawtimber and other purposes could also be used. In the naval stores region, there is also a considerable accumulation of longleaf and slash pines of small size that have been worked out and abandoned for turpentining and whose removal is necessary to free the ground for a new crop of trees.

Tree Diameter and Growth

In order to give a fair idea of the size-class dis-

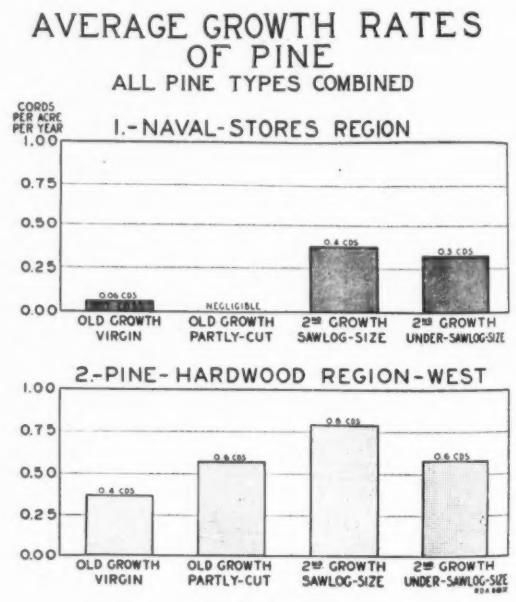


Fig. 7.

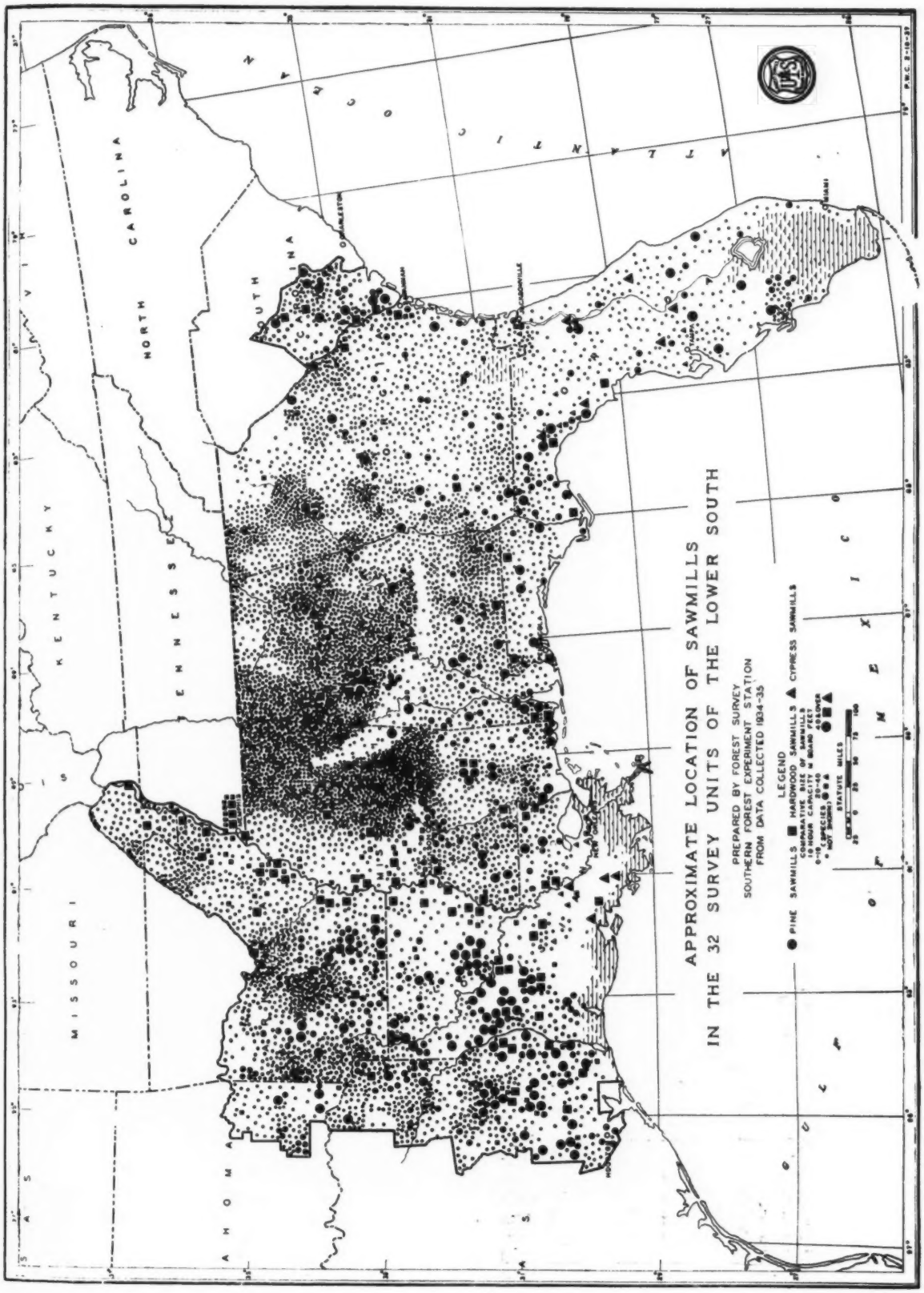

APPROXIMATE LOCATION OF SAWMILLS
IN THE 32 SURVEY UNITS OF THE LOWER SOUTH
PREPARED BY FOREST SURVEY
SOUTHERN FOREST EXPERIMENT STATION
FROM DATA COLLECTED 1934-35
LEGEND
PINE SAWMILLS HARDWOOD SAWMILLS CYPRESS SAWMILLS
COMPARATIVE SIZE OF SAWMILLS
10 HOUR CAPACITY IN BOARD FEET
0-25 SPECIES 25-40 40-OVER
• NOT SHOWN 50 & 75
STATUTE MILES
NORTH CAROLINA
SOUTH CAROLINA
KENTUCKY
TENNESSEE
MISSOURI
ARKANSAS
OKLAHOMA
MISSISSIPPI
ALABAMA
GEORGIA
LOUISIANA
TEXAS
FLORIDA

FIG. 8.

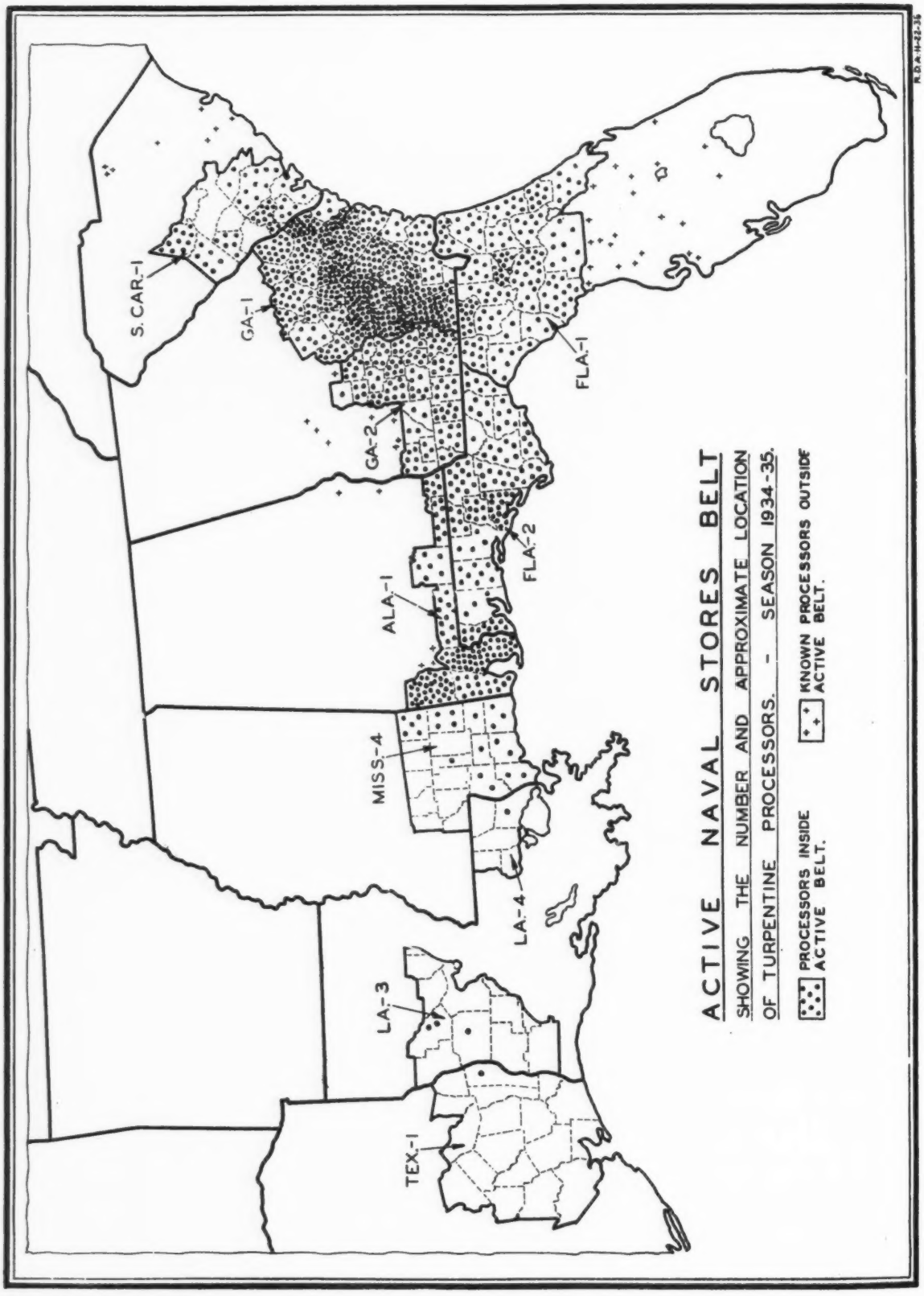

ACTIVE NAVAL STORES BELT
SHOWING THE NUMBER AND APPROXIMATE LOCATION
OF TURPENTINE PROCESSORS. - SEASON 1934-35.
PROCESSORS INSIDE ACTIVE BELT.
KNOWN PROCESSORS OUTSIDE ACTIVE BELT.
S. CAR.-1
GA.-1
GA.-2
FLA.-1
FLA.-2
ALA.-1
MISS.-4
LA.-4
LA.-3
TEX.-1

FIG. 9.

tribution in the pines, Fig. 6 has been prepared to show graphically the entire stand of sound pine trees in the naval stores and pine-hardwood west regions, classified according to 4-inch diameter groups. In general, the two patterns are much the same and represent the silhouette of a growing forest, with a large number of trees in the smaller diameter groups and a progressively smaller number of trees in each succeeding diameter group. The chart is interesting because it indicates that the necessary trees for an increasing future yield are on the ground and can be realized on if the proper measures are taken to reduce the heavy mortality that now prevails.

Fig. 7 shows the average annual per acre growth of pine in the naval stores and pine-hardwood West Regions expressed in cords. The figures given represent, for all of the pine types combined and for all sites and degrees of stocking, the average net annual increase in cordwood volume if no cutting takes place, and after deduction has been made for losses due to natural causes. The increments shown are strictly woods run averages that are actually occurring over large acreages at the present time.

Differences between the two regions are due in part to the fact that in the pine-hardwood west the stands are better stocked on the average than those in the naval stores region, as well as to the fact that the trees themselves show a slightly higher growth rate. Responsible in large part for the low net increment in the naval stores region—besides lighter average stands—are the reduced growth and higher mortality of trees that have been worked for turpentine. Turpentining, besides slowing up the growth, greatly increases the susceptibility of the tree to fire and insect damage, with the result that the turpentined timber in this region shows, on an average, a net annual loss in volume rather than a gain. The growth of pine that has not been turpentined, however, compares favorable with that of pines elsewhere.

In stands of second-growth pine, which from a pulpwood standpoint are of prime interest, the combined better and poorer sawlog-size stands in the naval stores region average approximately 0.4 cord per acre per year, while the under-sawlog-size stands average slightly more than 0.3 cord. In the pine-hardwood west, the sawlog site stands on second growth average approximately 0.8 of a cord per acre per year; and the under-sawlog-size stands, 0.6 of a cord. These are the annual increments in wild, unprotected, untended stands based upon the growth behavior of the last ten years. What effect fire protection, thinning and forest management might have in increasing the increments has not been established, but there is no doubt in my mind that they could be doubled at the least. In the assembly of lands for a pulpwood forest an immediate improvement of the growth rate could be accomplished by the simple process of taking only the best stocked areas and eliminating the poorer sites and conditions. Reliable figures are not available for the annual production of planted stands, but it can be safely stated that such growth rates are greatly in excess of those shown here.

Because, to save time, the survey distributed many of its findings as to the growing stock of timber before it did the results of its studies of existing forest industries, some of our pulp mill prospectors seem to have the impression that the south's forest wealth is only now being discovered. That this is far from the true situation is shown in Figs. 8, 9, and 10 which show, respectively, the distribution of sawmills, turpentine stills, and pulp mills in southern survey territory. Although they can be touched on only briefly here, each is a study in itself.

Geographical Distribution

On the sawmill map, the mills—8,112 of them—are classified as pine, hardwood, or cypress mills and grouped into three size-classes: large mills, medium-size mills, and small mills. Of the 8,112 mills shown, 6,713 are classified as pine mills. Of these pine mills, 92 per cent are small mills with daily capacities of less than 20 M bd. ft.; 6 per cent are of medium size with capacities of from 20 to 39 M bd. ft.; and only 142, or 2 per cent are in the large-mill class, with daily capacities of 40 M bd. ft. or more. The 92 per cent of small mills produce 47 per cent of the pine lumber cut; the 6 per cent of medium-size mills cut 17 per cent of the pine lumber, and the 2 per cent of large mills cut 36 per cent. The small and medium-size mills depend in a large measure on second-growth pine for their log supply.

The turpentine still map shows the location of 1,160 turpentine stills, as well as 21 wood naval-stores plants utilizing seasoned pine stumpwood left after the original longleaf pine forest was cut. As the map shows, the gum naval-stores industry is concentrated in the southeast with almost 82 per cent of the stills in Georgia and Florida. The turpentine industry is based almost entirely on the use of second-growth longleaf and slash pine timber.

The pulp mill map shows a total of 27 mills, either established or well assured, in the territory south and west of North Carolina. Eleven of these mills have come South within the last three years. In the naval stores region there are or will be 13 mills, in the pine-hardwood west, 10, in the pine-hardwood east, 3, and in the delta hardwood region, 1, the last one using hardwood exclusively. When the new mills are finished the pulp producing capacity of the territory will have been increased by approximately 120 per cent.

Besides the forest industry establishments shown on these maps, there are more than 600 others that are not shown—veneer plants, stave mills, small dimension manufacturers, and others. The total number of forest industry establishments of all kinds—lumber, naval stores, pulp mills, and others—is approximately 10,000, over four-fifths of them dependent primarily on southern pine for their timber supplies.

Fig. 11 compares the amount of employment given by the different forest industries in the naval stores and pine-hardwood west regions during 1934. It does not include the new pulp mills. By 1938 the picture will have a different pattern, with pulp mill employment ranking much higher in the scale. In the naval stores region, the turpentine industry was by far the largest employer of the group, accounting for 46 per cent of the 19.5 million man-days of employment given by the forest industries during 1934. The lumber industry was next with 28 per cent, veneer plants were third with 7 per cent, pulp mills fourth with 6 per cent, crosstie producers and the wood naval stores industry each accounted for 5 per cent, and the other forest industries accounted for the remaining 3 per cent of the forest industry employment during that year.

In the pine-hardwood west, of 8.5 million man-days of employment given by the forest-products in-

dustries during 1934, the lumber industry accounted for 65 per cent, the pulp industry was next with 15 per cent, crossties were third with 9 per cent, veneer plants accounted for 3 per cent, and other forest industries for the remaining 8 per cent.

Annual Increments

In Fig. 12 the annual net increment of pine in two portions of southern survey territory is compared with the estimated annual requirements of the forest industries and for domestic use in the same areas. The estimates are on a 1937 basis, except that the probable requirements of the projected new pulp mills have been added to give a more realistic picture of the situation. A proper analysis of conditions requires, of course, a much more thorough study than the mere balancing of end-figures of increment and drain. This chart is presented, therefore, as indicat-

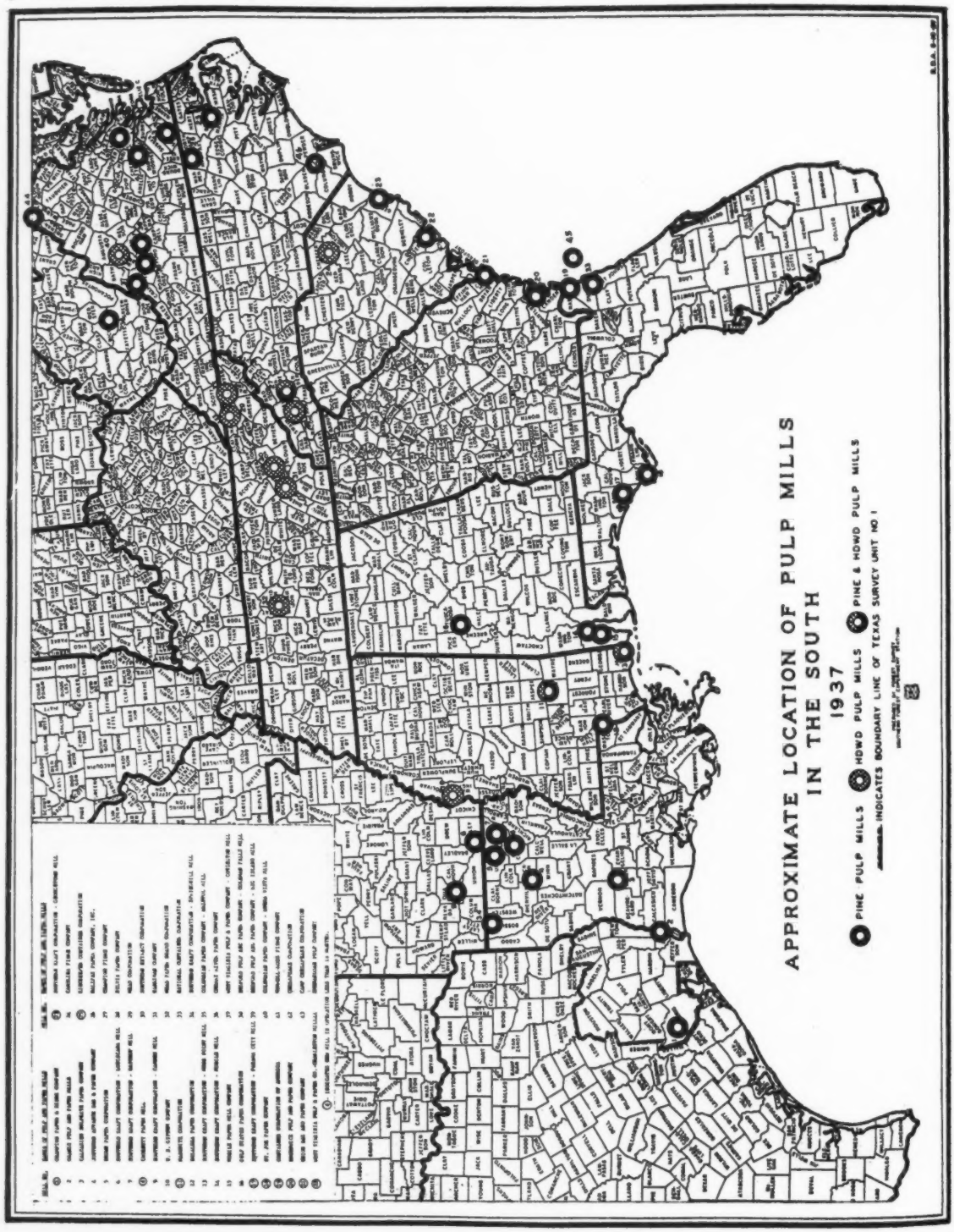

APPROXIMATE LOCATION OF PULP MILLS
IN THE SOUTH
1937
PINE PULP MILLS
HDWD PULP MILLS
PINE & HDWD PULP MILLS
INDICATES BOUNDARY LINE OF TEXAS SURVEY UNIT NO 1

FIG. 10.

ing only in a general way the degree to which timber use in the areas specified is adjusted to the growth that is taking place in the same areas.

In both of the areas—that is, in 8 of the 10 survey units in the naval stores region (the two south Florida units are not included) and in 5 of the 7 pine-hardwood west units (Arkansas No. 4 and Oklahoma No. 1 are not included) the lumber industry is the largest user, accounting for 54 per cent and 63 per cent of the total, respectively, in the two regions. The pulp and paper industry—figuring in the new mills—is second in the naval stores area with 20 per cent of the estimated requirements and third in the pine-hardwood west area with 7 per cent of the total need. In the naval stores area, approximately two-thirds of the pulpwood requirement is contributed by new pulp mills; in the pine-hardwood west area, less than half (approximately two-fifths). Fuel, farm, and domestic use—made up of the combined requirements of a multitude of small users—is third in the naval stores area with 15 per cent of the total, and second in the pine-hardwood west area with 22 per cent. The fourth large use of timber in the two areas specified is for railroad crossties, accounting for 5 per cent in the naval stores and 6 per cent in the pine-hardwood west. Other forest industries make up 6 per cent and 2 per cent in the two regions, respectively.

Meeting Future Needs

In the area embraced by the 8 Naval Stores units, the estimated present increment of 4,670,000 cords falls almost 2 million cords short of the estimated requirements (new mills included) of 6,570,000 cords. In the Pine-Hardwood West area, on the other hand, the present increment of 8,940,000 cords is approximately 1½ million cords in excess of the estimated requirement of 7,500,000 cords. The present increments shown are, as explained later, probably somewhat less than the average annual increments for the next ten years; nevertheless the growth and drain situation in the Naval Stores Region indicates that the present pulp mills must not only build up and secure the growing stocks tributary to their mills, but that they must look to the forest region to the north or west for a part of their supply. The location of additional large mills in the naval stores region at this time will undoubtedly threaten the future supply of the lumber, pole, tie and turpentine industries and perhaps endanger their own future prospects.

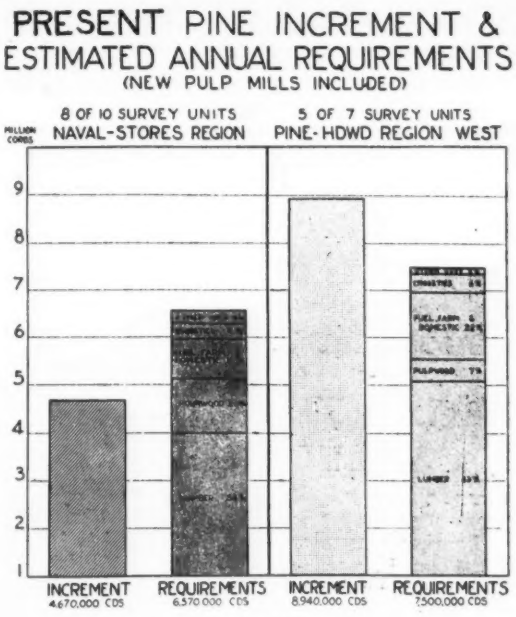


FIG. 12.

Situation Not Static

The situation as shown, however, is not static. The present balance of increment and use can be considered only as the present condition in a changing situation governed by the interaction of a number of factors. In the first place, the year-to-year requirements of the non-pulping forest industries are subject to a certain amount of fluctuation. In the second place the gradual removal of the remaining stands of mature original timber, although necessitating some downward adjustment in the lumber industry, will result in an increasing proportion of second growth, with its more rapid growth rate and the resulting greater increment. Another factor, one of considerable importance in the naval stores region, will be the natural building up of now lightly stocked stands through gradually extended and improved fire control and better forest management, which will eventually result in a considerably higher total increment. Again, the utilization for pulpwood in the naval stores region of the accumulation of worked-out, small-size turpentine timber will result in the use of material that would otherwise be lost because of the high year-to-year mortality in such timber; the result being a lower average mortality rate and a higher net increment. Other elements enter into the situation, and the future depends in no small part upon the things that timberland owners, the forest industries, and the public do, or do not do, to help themselves and each other.

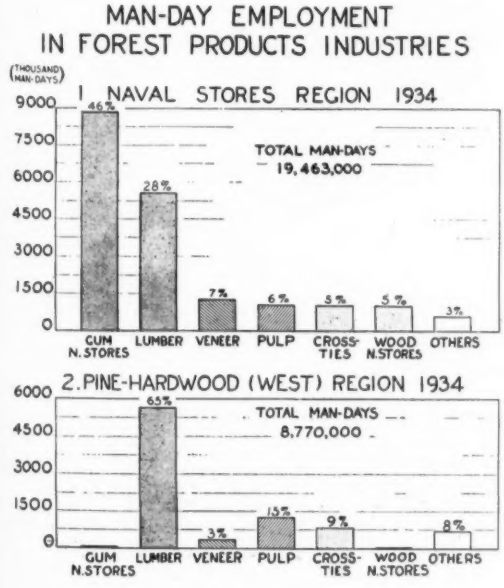


FIG. 11.

One thing is certain—the new forests of the south are going to be more intensively used than ever before. If we are not to repeat the sorry cycle of cut out, get out, and suffer, that we still remember with regret, we must plan and act with intelligence and restraint and with a sound understanding of the natural and economic laws that govern and justify sustained yield management of forest lands.

At last the forests of the lower south are coming into their own. For thirty years foresters and economists have been waging a stubborn uphill battle to gain general acceptance of the principle that our forest wealth need not be dissipated to meet the requirements of American progress—that it could be used with reasonable restraint and a common sense regard for the natural laws of forest regeneration and still amply serve present economic needs while building mightily for the future. For many years the fight for conservation in the south looked like a losing one—the gains were large but intangible while the losses were spectacular. In the last three decades, for instance, over 80 per cent of the virgin timberland area that then existed has been exploited of every vistage of value that men and machines could remove and the markets would absorb. Apparently timberland owners generally were not interested in the future of their holdings.

But as I look back now over those years and the economic conditions that governed men's actions I realize that the times were not fully ripe for a widespread acceptance by industry of the forester's preachments. The markets then could absorb only high-grade material afforded by old-growth timber and the supply of such timber, for a long time at least, was greatly in excess of the demand. It was cheaper to move the mill to a new supply of already mature timber than to grow a new crop of equal quality on the home grounds. After all, timber growing, as an economic enterprise, is only possible where markets and manufacturing facilities are both localized and stable, and where all the products of the forest, minor as well as major, can be turned into profit.

The years have passed and now, more by the grace of God than by any act of man, a new crop of timber has covered the stumps of yesterday and in this magnificent, far-reaching young forest lies one of the South's greatest hopes for its future security. In this year of 1937, the conditions are, I believe, more favorable for the development of forestry as an industry than in any part of the western world. Steady markets have developed for the products from second-growth timber and these markets have broadened to include nearly all sizes, qualities and species of trees. Transportation, manufacturing and marketing facilities are available now that did not exist a few years ago. That one timber crop will follow another even under severe handicaps and do it while you wait has been demonstrated in all parts of the south and in all forest types; nearly 75 per cent of our forest area is stocked with stands that started since the turn of the present century. We know now that timber is a rapidly renewable crop and that a business can be projected and run indefinitely in a fixed location on the sound basis of continuous forest yield. No longer must the forest-using industries be transitory enterprises forever uneasily preoccupied with an uncertainty as to future supplies of raw material. In all parts of the south there are vast areas of already stocked pine and hardwood forest lands that invite the investment of capital in their assembly, organization and development as permanent plants for the production of low cost forest products.

The south heartily welcomes the remarkable recent expansion of your pulp and paper industry. Our young forests need an outlet for low-grade material, our railroads and ports need your tonnage, our states and counties need your strengthening of the tax base, and above all our people need the opportunity for profitable employment in mill and woods. And we foresters, too, welcome you, for your coming has done and will do more to advance the actual practice of forestry than any movement that has yet taken place in the south.

The benefits to be derived are so many and so obvious that there probably is not a chamber of commerce in the south that is not eagerly seeking a pulp mill for its city. Regardless of these cordial invitations it is only fair to point out that the south of today is not the south of thirty years ago that stood complacently by and saw its timber wealth liquidated and shipped out of the country in a few short decades. This south remembers too well those hard bitter years of community depression that followed when the last mill sounded its final whistle and left desolate, tax delinquent stump fields behind for the consolation of a disillusioned people. While with the passing of time new forests have come to brighten the scene there are still gaunt reminders in nearly all communities of what happens when a get-rich-quick, cut-and-move-out system of forest utilization is allowed free reign. Our people have learned a lot since 1905 and now realize that the rapid dissipation of forest wealth is too high a price to pay for temporary prosperity based upon fleeting forest industries. The public has, to a large degree, become forestry minded and cannot be expected to long remain friendly to any industry that threatens the continuity of its forest assets.

We believe that in the pulp and paper mills, the south is getting an industry that can and will be with us as long as people buy paper. We believe that our long growing season, fast-growing species, low taxes and attractive working conditions will make it possible for you to occupy your initial mill sites indefinitely and grow your timber as fast as you need it, and at a lower cost than in any other section of the country. Intelligent self interest in the protection of your huge plant investments, it seems to us, will inevitably lead you to the acquirement of adequate forest lands of your own, to the practice of sustained yield forestry on them and to the encouragement of equally good forestry on the lands of others tributary to your mills.

If you live up to these expectations and distribute your plants with full regard of existing and expected timber requirements of competing industries, your industry has room for further expansion in the south without fear as to its future timber supply. Such an industry can be one of the most important constructive forces in the development of our section of the country since Eli Whitney invented the cotton gin. An industry based upon a short-sighted policy of rapid exploitation that displays an indifference to the future welfare of the communities and regions involved, however, will not only bring an angry and hostile south about its ears, but will throw away the greatest opportunity it has eve had or will have to seat itself permanently in the midst of low-priced wood.

Relationship Between Pine for Saw-Timber, Pulpwood and Naval Stores*

A. E. Wackerman[1]

Abstract

A review of the supplemental relationship in forest utilization between the requirements of southern pine for naval stores, saw timber and wood pulp production and the need for good management in the woods.

For a great many years the southern pine lumber and the naval stores industries were the principal users of southern pine forests but now these older industries have a new neighbor in the pulp and paper industry which has recently expanded southward, and which will require large amounts of pine pulpwood annually. I take it for granted that the southern developments in the pulp and paper industry are predicated on permanence and I know that the southern pine lumber industry is here to stay. As for naval stores, there is every reason to believe that so long as there is long-leaf and slash pine timber, turpentining will be an important use in such forests.

My discussion of the relationship between pine for pulpwood, saw-timber and naval stores is from the standpoint of permanent southern forest industries. It will not be quantitative as to timber supplies as that subject has been so admirably discussed by Captain Eldredge. Rather I will point out some opportunities for integrated use of southern pine forests and the developments that it seems reasonable to expect will materialize to assure adequate timber supplies of all kinds for all industries.

The magnitude of the pulp and paper industry, coming to a forest region already supporting the lumber, naval stores and other wood-using industries naturally raises a question as to the availability of permanent timber supplies and the competitive nature of each industry's requirements.

Extensive areas of commercially useful timber species are, of course, the foundation of all forest industries in the south. Best estimates place the total forest area of the eleven southern states at 190,000,000 acres of which about 150,000,000 acres are in pine. An important influence in the utilization of southern pine is the accessibility of practically the entire forest area. The south, unlike some important forest areas, is not a wilderness, rather it is a civilized region reasonably well developed agriculturally and with a large rural population and many small to large villages, towns, and cities throughout its entire extent. Excellent transportation facilities are available including highways, railroads and waterways. Predominantly young and growing rapidly, southern pine forests occupy most of the upland areas of the coastal plain and are of utmost economic importance to this entire section of the United States.

Will the greatly expanded demand for pulpwood, estimated to be 4,500,000 cords per year, cause large scale clean cutting of young timber and the destruction of productive forests; or will southern forests be managed for the continued production not only of pulpwood but of saw-timber, naval stores, poles, piling, ties, veneer bolts, and other useful and needed products? If forest industries failed to assume the responsibilities of forest ownership to assure the maintenance of their timber needs then there would, indeed, be reason for much uncertainty about the effect of a large demand for pulpwood on the permanence of timber supplies for other important industries.

Industrial Forest Ownership Essential

From long experience in supplying their sawmills with logs, lumbermen realize the necessity and advisability of owning enough forest land to guarantee a substantial proportion of their timber requirements. When the only method of logging was by railroad and heavy log-moving machinery, it was essential to acquire timber in large blocks as the heavy logging expense necessitated large concentrated operations. Now, although trucks and other transportation facilities permit random logging over a wide area, lumbermen recognize more than ever before the need for large forest ownerships primarily to assure their operations of continuous saw-timber supplies. A large amount, perhaps 50 per cent, of the pine lumber produced in the south comes from logs delivered to the mills by farmers and other small timber owners and from short term timber leases but there is no assurance to lumber companies that this source of logs can long be depended upon, and of necessity productive forests must be owned to provide continually a substantial proportion of the saw-timber needs of lumber companies.

As a guarantee that sufficient saw-timber of the desired quality always will be available to the mills, those planning prolonged or permanent lumbering operations have placed their faith in forest ownership and skillful forest management. Lumber manufacturers depending largely or entirely upon others to grow their saw-timber will be constantly jeopardized by the competition of other industries and other saw-mills requiring pine timber and will probably have an uncertain future.

Indicative of the rapid progress made by forest-owning lumber companies toward growing their own timber is the fact that a dozen or more already practice selective cutting and harvest only trees that have been marked by trained men with particular emphasis being given to leaving a properly spaced stand of growing timber behind logging that will permit selective cutting at intervals of 10 or 15 years. Such methods were rare, indeed, no longer than five years ago. Many other companies have adopted less intensive selective cutting, usually setting a safe minimum diameter cutting limit, thereby reserving the suitable

* Presented at the Fall Meeting of the Technical Association of the Pulp and Paper Industry, DeSoto Hotel, Savannah, Ga., Oct. 18-21, 1937.

[1] Industrial Forester, Seaboard Air Line Railway, Norfolk, Va.

small trees for future saw-timber. It is reliably estimated that practically 50 per cent of the forest area owned by operating lumber companies in the south is managed to sustain the output of the mills. Most of the remainder is so cut that the forest is left in condition to grow substantial amounts of timber whether or not the mills are assured of continuous operations. Selective cutting for saw-timber is rapidly becoming the standard practice on the lands of forest-owning companies and has revolutionized the industry by placing it on a stable and permanent basis.

Pulp companies by the acquisition of large areas of forest land tributary to their plants obviously have also accepted the premise that it is advisable to own and manage substantial areas of forest land to eliminate any question as to their future pulpwood supplies. Although other lands support a tremendous amount of young timber suitable for pulpwood, there is no assurance that all of it can be obtained for pulpwood, nor is there any assurance that once it is cut the owners will grow another crop. A great number of small saw-mills operating almost entirely on small timber are in direct competition for the timber in small ownership not only with forest-owning saw-mills but with the pulp mills as well.

The naval stores industry, probably because it, as a rule, utilizes trees for only a few years and because the majority of the units are small, is not generally a forest-owning industry. It is true that there are a number of forest properties managed primarily for naval stores but by far the greatest production of gum comes from timber leased for from three to five years and from gum delivered to the stills by others. With the expansion of steam stills and large naval stores refining plants it may develop that such companies also will find it to their advantage to become forest owners and manage their properties as a permanent source of at least a portion of their requirements.

Increasing forest utilization, therefore, is forcing all industries dependent upon timber into forest ownership. Many individuals and forest-owning companies are increasing their forest holdings; others are acquiring forest properties because they believe that growing timber, in the light of industrial needs for southern pine, is a sound investment. This is a reversal of the trend towards disintegration of large forest holdings that started after virgin timber had been cut and before it was realized how rapidly second-growth would mature.

So long as pulp mills, saw-mills and other users of timber could obtain their requirements from extensive, though unmanaged, forests there was but little or no need to consider building up greater timber yields from the areas owned. But the prospects of continued and increasing demands for southern pine products make it obvious that each major unit of the forest industries must protect itself from excessive competition for wood, not only from other industries but from other units of the same industry. I anticipate, therefore, the continued integration of large forest properties as good business not only for the protection of raw material supplies of industrial plants, but also as sound investments by non-operating owners.

Application of Forestry Measures Will Multiply Timber Yields

Most of the forest land of the south supports a stand of timber much less than is reasonably possible and the amount of growth now being obtained is but a fraction of what it could be. A growing stock, or forest capital, of healthy trees is essential before southern pine forests can produce large yields per acre. Much of the acreage that is being acquired for large holdings, therefore, will require several years of fire protection and stand improvement, such as thinning and the removal of mature and worthless trees obstructing the growth of others, before it will be in condition to permit regular harvest cuttings.

During the period that such properties are being brought to a productive condition forest industries undoubtedly will draw heavily upon the timber available from other owners. That there will be over-cutting, from a forestry viewpoint, on the properties of those not interested in forest ownership and willing to sell out is but natural, but what other people do with their timber is their own business, even though it is poor business. Everyone owning forest land cannot be expected to adopt a long-range timber-growing program and practice good forestry. Some are not interested in that kind of a business and some must liquidate their timber assets because of financial considerations peculiar to their own affairs. Others, of course, will strip their land of timber, even small trees, because they do not have the necessary information or inclination to practice good forestry.

A substantial area in industrial ownership together with other forest properties managed for timber growing, however, should allay any fears as to future timber supplies after such properties have been brought to a point where regular cutting operations are justified. Intensive forestry is entirely practicable on the larger properties and southern pine is so responsive to cultural measures that informed permanent owners, whether lumber companies, pulp companies, naval stores operators or individuals will undoubtedly find it attractive to manage their forests for the greatest production per acre consistent with markets, prices, and the costs involved.

Greater per acre timber yields will be obtained, on the average, from the larger properties than from small, scattered ownerships because better forestry can be practiced. A fundamental requirement of good forest management is stable ownership and forests owned by operating units of the forest industries undoubtedly will be dedicated to supplying forest products continuously. Forests so owned and varying upward from 30,000 acres in size justify full time technical forestry supervision, and a competent forester by skillfully applying his professional knowledge can increase the amount and quality of timber yields from a forest just as a good agriculturist can increase crop yields by proper rotations, fertilization, and cultivation.

Personally, I feel that we have but barely scratched the surface of forestry in southern pines, and there is no knowledge as to the maximum amount of timber that can be grown per acre when forestry measures are applied continuously from the time a full stand of young timber is large enough for the first thinning. An annual yield of 500 board feet of saw-timber and one cord of pulpwood per acre as a by-product is, I believe, not at all an unreasonable expectation on good sites when intensive forest management is justified by markets that permit complete utilization of all trees grown.

Saw-Timber and Naval Stores Forests Yield Pulpwood

While lumber company forests are and will be managed primarily to yield high quality saw-timber yet a large amount of other forest products also will be produced. Saw-timber requires large trees and large trees of good quality cannot be grown unless reasonably dense stands are maintained throughout the entire period during which saw-timber trees mature. A great many more trees must be started per acre than can possibly survive to maturity and in natural stands the struggle for existence between the trees as they increase in size results in the death of most of them and slow growth for those that survive. As such a stand gets older and the trees larger there must be, therefore, a constant decrease in the number per acre. This means that there is a constant surplus of trees in a forest growing saw-timber. Good forestry requires that growing timber be thinned at frequent intervals to favor the best individuals and to keep them properly spaced and growing rapidly.

When saw-timber is cut a considerable portion of the upper part of the tree is either too small or too knotty for the better grades of lumber but is suitable for pulpwood. In addition, even with the most careful logging, there is some breakage of smaller trees and these also make good pulpwood. If such material is not utilized for some product other than lumber, it must be left on the ground to rot, creating a serious fire hazard and constituting an economic waste. The Sixteenth Annual Report of the Southern Forest Experiment Station of the U. S. Forest Service in discussing a pulpwood production study states that pulpwood cut from the tops of second-growth pine trees is acceptable to pulp mills and that on the average a production of one-half a cord of good pulpwood can be obtained per thousand board feet of saw-logs cut. More usable pulpwood is obtained in proportion to tree volume from the smaller sized trees than from larger ones, trees over 20 inches in diameter containing but very little pulpwood in the tops. On the basis of total usable volume in cubic feet, trees 12 inches in diameter are shown to be only 71 per cent usable for saw-logs and 29 per cent usable for pulpwood. The percentage of pulpwood volume per tree decreases with increased tree size; 14 inch trees being 24 per cent pulpwood, 16 inch trees 19 per cent; 18 inch trees 16 per cent, and 20 inch trees 12 per cent.

That it is feasible to utilize thinnings and logging waste for pulpwood is evidenced by experiences of several lumber companies in producing pulpwood from this material. One company practicing intensive forest management on a large area of shortleaf and loblolly pine timber, produces 500 cords of pulpwood a month from thinnings and salvage cuttings behind logging. Much more could be produced as a by-product of the company's timber growing program if the market needed it. Thinning even-aged stands from 18 to 25 years of age yields on the average 4 cords per acre, and thinning stands 25 to 40 years of age yields an average of 6 cords per acre. In as much as thinning operations must be repeated every few years to maintain their effectiveness, these yields are continuous until the trees mature to saw-timber size. The same company obtains about 2½ cords of pulpwood per acre behind logging which is at the rate of ¼ cord per thousand feet of logs cut; from two to three cuts of pulpwood being obtained from each saw-log tree.

Another company operating in shortleaf and loblolly pine averages from 4 to 6 units (5-foot cords) per acre from thinnings in stands of various ages. One stand 42 years old yielded 21 units per acre and 21 units were left for saw-timber. A 31-year old stand yielded 12¼ units, and 12¼ units were left standing. Pulpwood from salvage cuttings behind logging on this operation averages 1¼ units per M feet of logs cut from second-growth stands which is more than the average because low grade top logs are also made into pulpwood.

Still another lumber company in the shortleaf-loblolly pine region has experimented with salvage cutting for pulpwood behind logging in cooperation with its State forestry agency and a pulp and paper company. It was found that in second-growth timber an average of 1½ cords per acre of suitable wood could be obtained but that the cost exceeded the returns and under present conditions, therefore, the operation is unprofitable. Several other companies have experimented with cutting pulpwood, and most have found that, although good pulpwood can be produced, yet the cost at present does not make it economically possible. However, as more economical methods of producing this material are perfected most lumber companies in the vicinity of a pulp mill should be able to furnish pulpwood regularly from thinnings and logging salvage.

A lumber company operating in longleaf pine has been for some time converting the tops of saw-log trees into pulpwood and obtains, from light stands, an average of ⅓ of a unit (5-foot cord) per acre or at the rate of about ¼ unit per thousand feet of logs cut. Usually 3 pieces of 5-foot wood are cut for pulpwood from the upper portions of the saw-log trees. The sale of this pulpwood has only returned about the cost of the operation, so from an income standpoint it is not particularly attractive although the obvious benefit of cleaning up the tops to reduce fire hazard makes it worth-while.

Forests managed primarily for naval stores probably will yield but little if any saw-timber because the round timber above the faces will be small when the trees are worked out and because trees with large crowns and short trunks, which are desired for turpentining, are not as a rule useful for lumber. Such forests will, however, be an important source of pulpwood as the worked-out trees must be removed to make room for a new crop of trees and heavy thinnings are advisable to hasten the growth and crown development of trees in young stands.

Pulp mills have the opportunity, therefore, to obtain substantial amounts of pulpwood from lumber company and naval stores forests in their localities when the price for wood is such that the owners can obtain a reasonable return from the operation. Such a source of supply should be attractive to pulp mills because it is a permanent supply and because every unit of pulpwood obtained as a by-product from saw-timber and naval stores forests reduces the requirements from young rapidly growing timber and, therefore, relieves the net drain on southern forests in general.

Pulp Company Forests Expected to Yield Diversified Forest Products

Just what will be the management policy of pulp companies' forests I, of course, do not know. Undoubtedly they will be developed into productive properties by fire protection and improvement meas-

ures designed to obtain at an early date a full stand of growing timber, primarily as insurance against a dearth of pulpwood supplies and as protection against unduly high prices for wood. For several years there probably will not be much timber cut on these holdings, except to the extent necessary to enhance the growth rate, and pulpwood will be obtained from other sources so long as the price is satisfactory. Whether or not it is the present intention of pulp companies to grow only pulpwood in their forests, I am confident that sooner or later it will be found advisable for pulp company forests to be managed for diversified timber products because of the much greater financial returns that will be possible.

It will be an important consideration, I believe, for pulp companies' forests to yield the greatest revenue, consistent, of course, with maintaining a pulpwood reserve to meet any mill requirements that may reasonably be expected to materialize. A productive forest sufficiently large to grow a mill's pulpwood requirements would represent a large per cent of the investment in a pulp and paper mill. A 200-ton mill representing an investment of, say, $4,000,000 would require an area of about 150,000 acres of pine timber with a growth potentiality of one cord per acre per year. At $5 an acre the forest purchase price would be $750,000, and by the time this area attained a productive capacity of one cord per acre per year the investment might easily be doubled or about 25 per cent of the total plant and forest investment. Such an important part of any business must produce the greatest return reasonably possible and it does not appear that pulpwood crops in themselves would furnish an adequate return especially when more valuable products can readily be grown in addition to a large amount of pulpwood.

If pulpwood is to be scarce this might be a doubtful procedure. However, with the pulpwood that is and will be available from managed saw-timber forests, and with the pulpwood that will be obtained from the pulp company forests, together with that available from worked out turpentined trees, and that which will no doubt be always available to some extent from farmers and other small owners it is doubtful if pulpwood will ever be scarce unless pulp production increases materially.

Integrated Forest Utilization

Here, then, is where the lumber, pulp and paper, and naval stores industries have much in common. Managed saw-timber forests will produce pulpwood and it will be good business for lumbermen to sell their pulpwood by-products at a reasonable price to pulp companies. Pulp companies, as I see it, will have the opportunity to make their own forests more productive of revenue, or of pulpwood, by growing saw-timber to be sold at market prices to the sawmills. The income from such sales could, naturally, be used to purchase open market wood and thereby obtain a greater amount of wood than the saw-timber trees actually would make if cut for pulpwood. Or an exchange of saw-timber for pulpwood could be effectuated between permanently established forest-owning units of both industries. Because saw-timber has a greater value than pulpwood the exchange would bring to the pulp mills two or three cords or more of good pulpwood for every cord of their own wood sold as saw-timber, thus in effect increasing the productivity of pulpmill forests even when viewed strictly from the standpoint of pulpwood yields.

Both lumber companies and pulp companies cannot afford to overlook the opportunity to dispose of the naval stores values in their timber when longleaf and slash pine forests are involved. Operating methods can be specified in any leases to permit economical naval stores operations that will not interfere materially with the yield of other timber products and will be to the mutual advantage of all three industries.

The producers of specialized forest products, such as poles, piling and veneer logs cannot very well own and manage forests primarily for their requirements because trees must be carefully selected for such purposes and the cut per acre is very small. They must depend upon others, therefore, to grow their timber needs and industry owned forests should, because of their permanence, be an excellent source of supply for such products. Company-owned forests, whether pulp or lumber, and other forest owners undoubtedly will find it advisable from an income standpoint to grow specialized forest products along with those more widely used.

The conclusion I reach from an analysis of the present and prospective utilization of southern pine forests is that there will be more and better timber available for all purposes in the future than there is at present. Second-growth timber of today, like Topsy, just grew. With a few notable exceptions no conscious effort was directed towards growing new crops of southern pine. Little, if any, attention was directed to the prevention of forest fires and it is only in recent years that there has been much real success in controlling fires.

Readily available timber from the wide expanse of southern pine forests in the past made intensive timber culture unnecessary, but now that it has been demonstrated, accidental though it was, that southern pine forests grow rapidly and produce a wide range of useful and necessary products, and since there are now ready markets for even small trees, forest ownership is attractive and intensive forest management entirely practicable. Because of increased demands for wood, the time has passed when any substantial unit of a forest products industry can avoid forest ownership if it is to have a prolonged or permanent operation.

While the expanded demand for southern pine timber might give the appearance of intense competition between forest users this need not necessarily develop, due to the fact that the three most important uses, saw-timber, pulpwood and naval stores, are supplemental in their demands on pine forests. Without conscious effort and planning on the part of the forest industries it is, of course, possible that competition and uneconomic and unnecessary timber utilization methods might become established. I have faith, however, in the business acumen of the men who direct the affairs of our forest industries and do not believe that unsound timber exploitation that might lead to governmental interference will be permitted. Rather, I confidently expect an expansion of the cooperative approach already manifest by forest industry leaders to the problem of orderly use of forests in the interest of all concerned, thus, to effectuate the maintenance and improvement of our great southern pine forests which are so capable, with the application of practical forestry measures, of furnishing forever all of our timber needs.

Wood Pulp Supply of the World*

By John Traquair[1]

Abstract

A survey of data relating to the wood-pulp supply of the world obtained from publication and trade association statistics.

As general chairman of the TAPPI Raw Materials Division I am taking the liberty of expanding the scope of this paper to include all fibrous raw materials, and also make reference to the last report of the Fibrous Raw Materials Committee published on August 27, 1936, which reviewed the United States situation.

Owing to the large number of recent publications I am omitting consideration of the United States and Canadian wood resources, except from the point of view that the United States is the world's largest importer of wood pulp.

Wood comprises 85 per cent of the fibrous raw materials used in paper making, and to quote from the Copeland report "although pulp can be produced from many fibrous materials no source of cellulose has yet been discovered which, either in suitability for most types of paper pulp or in cost per unit weight, challenges the supremacy of wood—in short, wood is the basic raw material for paper pulp."

Some years ago the Canadian Bank of Commerce published estimates of the distribution of timber throughout the world and stated that softwoods represented about one-third of the total. The estimate of the distribution of these softwoods, that is, wood best suited for pulp production, was as follows:

North America	40 per cent
Asia	35 per cent
Europe	21 per cent
South America	4 per cent
	100 per cent

This discloses the fact that North America has no monopoly on the stands of softwood, and this is true for the total timber stands of all paper and pulp wood species, but they require further interpretation in the light of present availability. The United States is the world's best customer for pulp and paper, consuming nearly one-half of all the pulp that is consigned to that market. Naturally this gives this country a dominating position, but when a shortage develops the result is reflected in advanced prices. There can be no doubt that the present price situation could not have arisen, but for increased requirements of United States paper mills during this last year.

Major J. S. D. M. Armour in an article in the World's Paper Trade Review for May 14, 1937 states "To summarise, the world's present annual consumption of forest products has now practically caught up with the existing maximum economic annual cut of the world's existing commercially accessible forest areas. As, however, populations increase and standards of living throughout the world rise, there is, naturally, a substantial normal annual increase in world consumption of forest products. In future, this normal annual increase must be even more substantial than in the past, for wood or wood products now enter increasingly more than ever before, either directly or indirectly, into every phase of human life and industrial activity."

It was pointed out in the Fibrous Raw Materials Committee report of August 1936 that the paper industry is not the only industry using basic wood cellulose as its raw material, for rayon, cellophane, staple fiber, certain lacquers, plastics and finishes all used increasing quantities of cellulose from wood, and it is estimated that this year nearly one million tons of bleached sulphite will be diverted to these uses. Not only so, but it is the cream of the sulphite production from the best of our softwoods that is being taken by industries, which can outbid the paper industry for this raw material, as the final price of their finished article is many times that of paper. The paper industry is thus in competition with the textile and other industries for cellulose raw materials, and the competition is growing.

It is noteworthy that on a percentage basis of the total wood used, spruce has consistently dropped from about 75 per cent in 1900 to 50 per cent in 1925 and about 31.2 per cent in 1935, and that other woods are being used. The development in the south which we are now witnessing demonstrates this trend and points to advances in technical knowledge which makes possible this broader utilization of previously unused wood supplies.

In the many years since wood pulp first became a paper making material an immense amount of work has been done in improving the processes and product. At the same time much work has been done in seeking other sources of raw materials from which a competitive cellulose could be made. During the years of 1920-30 this was particularly true and development work on straw, cornstalks, bagasse, Cuban cane and many other industrial and agricultural wastes was undertaken. The seven lean years of the depression proved most of these projects to be economically unsound. 1937 will possibly be known by future historians as the recovery year, and we are now confronted with rising prices and threats of shortage following increased consumption. Naturally this has had an effect in stimulating research and investigation and consideration of many abandoned projects.

There is an increased use of chemical pulp in paper making as compared with mechanical wood pulp to meet the requirements of better paper and stronger wrapping paper, hence the proportion of chemical pulp has risen from 50 to 60 per cent of late years. Production and consumption in 1936 were more or less balanced while numerous plant extensions were being carried out. Even if the requirements of this year keep step with this production, notwithstanding the increased price, it must be remembered that the main wood producing countries have just about reached the limit of annual wood cutting. It is clear that an opportunity is offered to the possible rivals of wood pulp, but the conditions are, that they must be competitive in price and their equal in quality. Esparto is a well established al-

* Presented at the Fall Meeting of the Technical Association of the Pulp and Paper Industry, DeSoto Hotel, Savannah, Ga., Oct. 18-21, 1937.

[1] Member TAPPI, Director of Research, Mead Corporation, Chillicothe, Ohio.

ternative, Bamboo is now established in India where most of the technical difficulties have been overcome and a third is straw, where despite technical difficulties, it is being manufactured successfully in Europe and used in the production of high grade bristols and papers where good color and snap are desirable. In the United States straw is still mainly used for corrugating board. Production in 1936 was 557,500 tons.

In reviewing the situation in the pulp and paper producing countries of the world we find that they are all endeavoring to produce to the maximum point that their resources will allow, but in some countries a nationalistic self-sufficiency program is in operation. In these countries only the minimum quantity of cellulose is allowed to be imported and attempts are being made to utilize all kinds of industrial wastes, with restrictions in size and quality of newspapers and other printed matter to balance the budget and attain self-sufficiency.

Actually 2000 or more species of plants are known to be possible sources of fibrous raw materials, only a very few, however, have been actually used industrially, except of course by native craftsmen. The possibilities of some of these species with proper cultivation and systematic breeding are unlimited when we consider what has been done with wheat, cotton, rubber, poplars, etc. The world gets along at present with a very few species, but it sometimes gets anxious about its future supplies. It is in this mood at present, and it is now the open season for all kinds of propositions on new sources of cellulose. You are all familiar with projects covering agricultural wastes, reeds, saw grass, canes, bagasse, ramie, etc.

We are witnessing the paper industry moving into the last large potential source of raw materials, preparing to "mine" in most cases the pine of the south. The next decade may demand a move to the tropics where the annual production of cellulose per acre is higher but more costly to make available in most cases.

It is quite a problem to get accurate figures for all the countries, and I have compared statistics from numerous sources.

The "World Wood Pulp Statistics 1926-1936", second edition, published by the United States Pulp Producer's Association gives the following figures for world production, estimated consumption, imports and exports: (I believe these are the most reliable figures obtainable).

WORLD FIGURES

(Total all Grades in Thousands of Short Tons)

	1936			
	Production	Estimated Consumption	Imports	Exports
United States	5,715	7,799	2,277	193
Canada	4,550	3,815	19	754
Sweden	3,478	971	6*	2,513
Germany	2,550	2,465	173	259
Finland	2,086	589	...	1,498
Norway	1,047	411	26*	662
Japan	866	1,231	366	...
Russia (U.S.S.R.)	772	775	3	...
Austria	371	190	4	185
Newfoundand	322	322	...	...
Czechoslovakia	316	202	7	121
France	226*	834	611	3
Poland	160	169	13	4
Italy	153	404	251	...
Great Britain	129	1,886	1,761	4*
Netherlands	119*	222	103	2
Estonia	98*	24	3	77
Switzerland	81*	100	22	3
Lithuania	61*	...	1	63
Roumania	56*	49	2*	9*
Latvia	26*	23	1	4
Denmark	7	60	53	...
"All Others"	...	536	558	24
Total	23,189	23,077	6,260	6,378

* Estimated.

"All Others" includes the following countries, where the estimated consumption and imports practically balance each other: Argentina, Australia, Belgium, Brazil, British India, Bulgaria, Chile, China Greece, Hungary, Spain and Yugoslavia.

Many countries rely mainly on local raw materials and this is especially true in the older civilizations.

The following brief notes on individual countries, while necessarily incomplete, endeavor to cover the outstanding features of the industry in each case.

China

China, for example, has the honor of being the mother country of paper making. Her pulp importation was about 15,000 tons in 1936. There are five paper mills in the Shanghai district, and a new Government mill is ready for operation in Southern China with a daily capacity of 50 tons of newsprint. This mill will use pine wood from Western Kwantung Province. The manufacture of handmade native paper is still an important industry in certain districts. There are also paper mills in Indo-China, and a pulp and paper mill in Java using rice straw as the raw material.

Japan

Japan's paper making industry is almost entirely modern, the domestic production having risen from 551 thousand tons in 1932 to 761 thousand tons in 1936. The imports of chemical pulp during the same period rose from 102 thousand tons to 331 thousand tons. However, Japan's rayon industry is rivaling the paper industry in its demand for cellulose. For example, of the 331 thousand tons of chemical pulp imported in 1936, 159 thousand tons were for paper making and 171 thousand tons for rayon. In 1936 Japan stepped into first place in the production of rayon and staple fiber. The United States is the main source of supply, having shipped 156,000 tons of chemical pulp to Japan in 1936.

The Japanese control mills in Chosen and Manchukuo and are endeavoring to find new sources of fibrous raw materials. Projects covering new mills for Northern Manchukuo for the production of cellulose from rice husks, soya bean husks, reeds, and even a pulp mill in British Columbia are under consideration.

Present conditions point to rapid expansion of the cellulose consuming industries in Japan.

British India

India produces no wood pulp, and imports under 20,000 tons of chemical pulp but has, a well established local paper industry using modern equipment, making paper mainly from bamboo and sabaigrass.

Australia

At present there is no wood pulp manufactured in Australia. A mill is projected at Derwent Valley, Tasmania which will make about 30,000 tons per year, mainly newsprint, from local woods. A mill also is in the process of construction at Burnie, Tasmania where local wood will be used. Australia imports about 40,000 tons per year of chemical pulp and has a well established industry, although the main tonnage is confined to cheaper boards and wrappings for local demands. A project to make pulp from kurukuru grass at Collingwood Bay, Papua has been reported from time to time.

NEW ZEALAND

Even New Zealand has three paper mills operating six fourdriniers and two yankee machines.

ARGENTINA

Argentina has a fairly well established paper industry, but does not manufacture wood pulp. The importation of pulp is slightly over 30,000 tons annually, mainly from Sweden and Germany. The Argentine, however, has one mill making about ten tons a day of bleached straw pulp by the Pomilio process, and this could be expanded owing to the large supply of wheat straw easily available. Plans for expansion of the industry by the largest manufacturer, Cellulosa Argentina, have been announced, to make the republic almost independent of foreign supplies.

CHILE

Chile imports around 12,000 tons, mainly sulphite, and has one small straw mill making bleached straw pulp by the Pomilio process, in addition to several plants using local cellulose supplies.

BRAZIL

No chemical wood pulp is produced in Brazil, but there is a well established paper industry, with a chemical wood pulp mill projected, if not in actual process of construction. About 90,000 tons of pulp, of which one-half was unbleached sulphite, were imported in 1936, mainly from European countries.

In the other South American countries the production is negligible.

TRINIDAD

Recently a small pulp plant was established on the Isle of Trinidad to manufacture pulp from bamboo, but as the production is small it can only be regarded as semi-commercial.

The history of the manufacture of pulp from Cuban cane is, of course, well known.

SOUTH AFRICA

South Africa has one paper mill and from time to time we hear of a projected mill to use native woods.

When we turn to the European countries, the situation is more complicated:

SPAIN

Spain, for example, had a well established paper industry, numerous small mills with only a very few that could be considered in any way modern. For the present, and I am afraid for many years to come Spain is out of the picture, and the Spanish situation is much more interesting from the point of view of social and political development than from paper making activities.

FRANCE

France produces about 225,000 tons of pulp. As government statistics on production are not available, estimates can only be made from other sources; however, about one-half million tons of wood pulp are imported of which one-fifth is mechanical pulp. Technical understandings in the form of conventions were reached last year between:

40 wrapping paper mills producing	200,000 tons
38 printing and writing mills producing	230,000 tons
24 straw paper mills producing	80,000 tons

In addition to this France has a considerable esparto pulp industry and makes a good deal of straw pulp for home consumption. Most of the French mills are small, but many are surprisingly efficient.

In the three dictator ruled countries of Europe (Italy, Germany and Russia) the aim is national self-sufficiency.

ITALY

Italy is a country of small mills which generally use local raw materials such as straw and agricultural wastes. Continual efforts are being made to develop the production of cellulose from native raw materials. Cultivation and hybridation of the Italian Poplar is being extended by Government organizations. The annual requirements are about 300,000 tons of cellulose of which 150,000 tons are for paper, 100,000 tons for silk and 50,000 tons for explosives. The home output is estimated at 25 per cent of requirements, and the 75 per cent is imported mainly from Russia, Austria and Czechoslovakia. For their own product poplar wood is used to the extent of about 150,000 tons and some 50,000 tons of Spruce are imported from Austria.

A new mill at Foggia using the chlorination process has been taken over by the State, and production is to be doubled to 60,000 tons.

Some of their old mills are being modernized. A five-year plan of tax free importation of machinery not available at present and specially needed for plant improvement is in force, and plants are instructed to produce on a scale of rigid economy and efficiency. In the endeavor to cut down the importation of raw materials, newspapers in Italy, for example, are restricted to six pages only, and rigid economy is enforced in the use of paper for printing purposes.

GERMANY

Germany is a large pulp producer, making 2.5 million tons, importing about 173,000 tons and exporting 257,000 tons. However, about two-thirds of the total quantity of spruce wood required in Germany for the production of cellulose has to be imported from other countries, mainly Russia (42 per cent), Czechoslovakia and Finland. To further her industrial plans the German forestry department have adopted measures to make available large quantities of pulp wood previously diverted to other industries. In this way it is hoped Germany will be less dependent on wood pulp and cellulose imported from other countries.

In June, 1937 Germany removed peeled and unpeeled logs, not over 8 feet long nor 12 inches in diameter from the list of articles requiring an import permit. It has also been decreed that all persons entering the paper trade as workers receive a certain schooling in the factory itself and the management is held responsible for seeing that the required instruction is given. Regulations regarding furnish to be used in certain grades are in force, and the use of waste paper is being encouraged.

RUSSIA

Much has been written regarding the industrial experiment in Russia during recent years, but it is not easy to sift the truth from the divergent views. Before the Revolution Russia had a small paper industry depending largely on Finland for its supplies. The entire paper output prior to the War was under 200,000 tons but in 1936 it was 763,700 tons, and it is expected this year to reach at least one million tons. Russia is actually producing more paper than Sweden and Norway. Home demand owing to edu-

cation and increased literacy will, I feel, take all Russia's pulp and paper production.

Russia's forests, especially those in Siberia where the stands are very scattered except near the Pacific Coast, are of little economic importance because they are commercially inaccessible to the outside world, and although Russia caused consternation in trade circles some years ago by dumping her easily available European forest products on the world market at any price obtainable, these exports were for the purpose of helping to create gold credits abroad to finance purchases for her five-year plans. Today, Russia shares with South Africa the position of the world's largest producer of gold, and so no longer needs to sacrifice her forest wealth to create gold credits.

Russia with her population of over 160 million is in the initial phase of industrial development, and just as the forests of the northern United States were needed to build up the United States of today, so Russia's remaining forests are required to build up the pre-planned self-contained industrialized U. S.S.R. and improve the standard of living of her teeming millions.

Holland and Belgium

These countries used about 312,000 tons of pulp mainly from Norway, Sweden and Finland. Dutch strawboard is well known, especially in the British market, and Dutch bristols have an international reputation. Paper making in these countries is highly developed; in fact the low countries were the early home of European paper making.

Great Britain

The paper industry of Great Britain is possibly most familiar to American and Canadian paper makers as many of them still keep alive old connections.

Britain does not publish yearly production figures, but the volume of output can be calculated from the Import figures. The British Paper Maker's Association annual report is the source of the following figures. Britain makes only about 16,000 tons of chemical wood pulp and imports practically all paper making raw materials. Next to the United States she is the world's largest customer, importing 1,165,000 tons in 1936 of chemical wood pulp mainly from Finland, Sweden and Norway. In addition to this 680,000 tons of groundwood pulp were imported.

The large modern news mills situated on the Thames, near London, are simply converting stations en route from the forests of Scandinavia to the Fleet Street daily journals.

Cargoes of groundwood and unbleached sulphite are discharged from the steamers into the mills and emerge as rolls of newsprint to be loaded on barges and complete their voyage to the printing presses of London.

In contract, a few miles away from the river on the Medway at Maidstone are situated some of the best handmade paper mills in the world, the home of Whatman papers, etc.

Another section of the British paper industry is the group of esparto mills mainly located in Scotland. Last year 322,000 tons of esparto grass were imported mainly from Algeria and Tunis, return cargoes of coal helped the freight rates on both wood pulp and esparto. The quality of Scottish esparto papers is recognized the world over. Substitutes such as Danube reeds are used to some extent, but esparto papers represent the standard of quality of all products from straws and grasses.

In Britain the use of fiber containers is growing rapidly, increasing yearly the demand for boards of all kinds, and some of their leading industrialists believe that pulp prices have not risen beyond an economic level and that the world is faced with a period of higher costs all around. The British importation of paper and board amounted to 1,168,000 tons in 1936 and the total importation of paper making materials amounted to 2,735,000 tons.

Baltic Countries—Norway, Sweden and Finland

These are the source of much of our foreign pulp, and we are all familiar with many of the old established quality brands.

"These countries have became acutely forest minded during the last 35 years and legislative, industrial and economic factors have now, in effect, resulted in placing their forests on the equivalent of a perpetual annual crop basis, the objective of scientific forestry all over the world. Their annual forest products export have now practically reached the limit imposed by the annual forest cut, and while the Baltic area can continue to supply indefinitely on the scale it now does, it cannot appreciably increase its present annual output"—*Armour*. Only in Finland has there been any real expansion of production planned.

The cost of wood pulp is closely linked with the price of timber. The regulation of the timber export from eight European wood exporting countries was undertaken in 1936-37 by the European Timber Exporters Convention formed in Copenhagen in 1935. It has had a beneficial effect in steadier production and prices. The price of timber turned definitely upward in the fall of 1936, and is still rising. (The Annual issue of the *Swedish Timber Trades and Wood Pulp Journal* printed partly in English reviews the Scandinavian industry and is a source of much information).

The United States imported from Sweden, Finland and Norway in 1936 the following:

Bleached Sulphite	168,390 tons
Unbleached Sulphite	608,468 tons
Sulphate	568,651 tons
Bleached Sulphate	47,131 tons
Mechanical wood pulp	57,434 tons
Total all grades	1,450,074* tons

* This represents just over ⅓ of the chemical pulp produced in these countries.
Germany and other European countries supplied 155,000 tons.

The other countries of Europe such as Poland, Switzerland, Austria Hungary, Yugoslavia and the Balkan States have only a minor export trade which goes mainly to neighboring states. Only Czechoslovakia has a considerable production and exported 120,000 tons of chemical pulp in 1936, of which 30,000 tons was consigned to the United States.

American Production

The graphs published are reproduced with the permission of the United States Pulp Producer's Association:

Fig. 1 shows the world wood pulp production—all grades.

Fig. 2 Sulphite production of leading countries.

Fig. 3 Sulphate production of leading countries

Fig. 4—Table 1 shows the productive capacity with capacity expansion scheduled for completion during 1937-38. It will be noted that 1937 will have

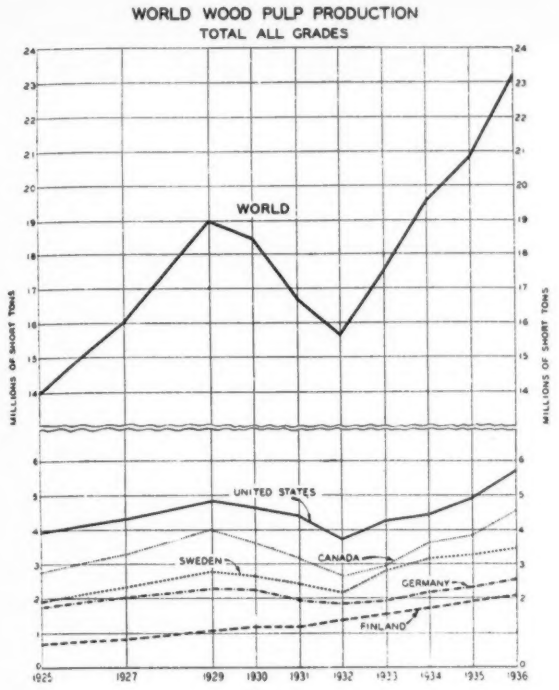


FIG. 1.

SULPHITE PULP PRODUCTION
(In thousands of tons)

	United States	Sweden	Germany	Canada	Finland
1925	1,403	1,061	923	843	331
1927	1,553	1,230	1,088	1,016	418
1929	1,689	1,358	1,212	1,236	517
1930	1,567	1,357	1,207	1,077	568
1931	1,417	1,144	988	942	574
1932	1,146	966	1,000	769	704
1933	1,328	1,303	1,024	910	752
1934	1,446	1,437	1,174	991	840
1935	1,576	1,498	1,247	1,019	928
1936	1,830	1,587	1,364	1,212	1,034

Sources: Given under detailed tables for Production data of the respective countries.

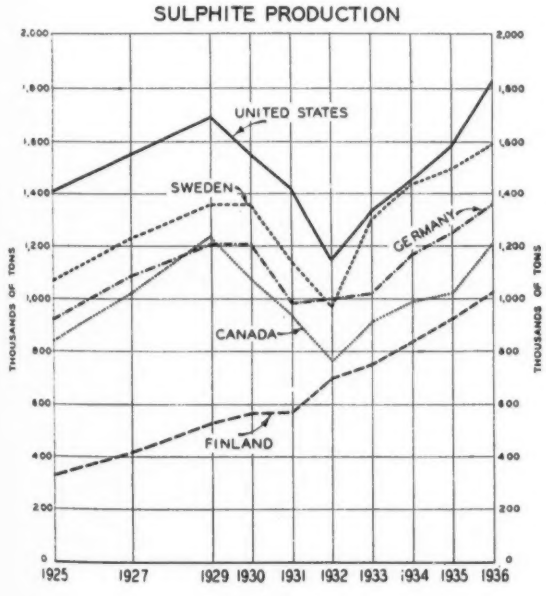


FIG. 2.

500,000 tons additional sulphite capacity and 1¼ million tons of sulphate. For 1938 only 180,000 tons of sulphite capacity will come into use, but another 500,000 tons of sulphate.

SULPHATE PULP PRODUCTION
(In thousands of tons)

	United States	Sweden	Finland	Canada
1925	410	366	107	242
1927	603	499	128	263
1929	911	716	172	250
1930	950	686	207	188
1931	1,034	674	211	145
1932	1,029	685	255	144
1933	1,259	848	261	183
1934	1,246	990	288	221
1935	1,468	1,044	324	257
1936	1,817	1,141	429	287

Sources: Given under detailed tables for Production data of the respective countries.

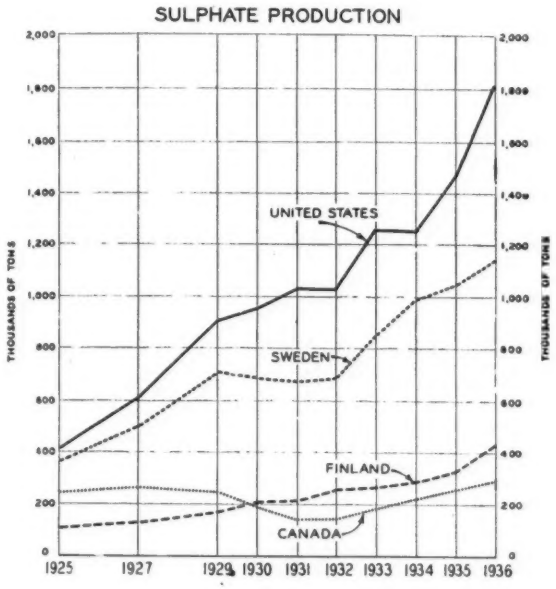


FIG. 3.

WOOD PULP PRODUCTIVE CAPACITY AND CAPACITY EXPANSION
(In tons of 2,000 pounds)

Capacity as used in these tables means annual (310 days) capacity for production of pulp for sale and for mills' own consumption.

SULPHITE

Country	Productive Capacity Jan. 1, 1936	Capacity Expansion scheduled for completion during 1936	1937	1938
United States	2,045,070	92,380	253,890	57,350
Canada	1,574,000	.....	165,780	103,075
Sweden	1,800,000	8,800	7,000	.....
Finland	1,110,000	6,600	44,000	.....
Norway	500,000	.....	.....	.....
Germany	1,300,000	.....	38,750	.....
Poland	72,600	.....	.....	20,000
Great Britain	16,800	.....	.....	.....
Latvia	.....	.....	22,000	.....
Total	8,418,470	107,780	531,420	180,425

SULPHATE

United States	1,659,430	235,290	1,011,840	282,100
Canada	282,000	.....	31,000	64,500
Sweden	1,120,000	65,000	27,500	16,500
Finland	400,000	27,500	136,500	110,000
Norway	75,000	.....	5,500	33,000
Germany	55,000	.....	33,000	.....
Poland	22,000	.....	.....	.....
Estonia	0	.....	.....	33,000
Great Britain	0	.....	.....	.....
Latvia	.....	.....	38,500	.....
Total	3,613,430	327,790	1,283,840	521,100

Source: The Capacity figures given above have been compiled from authoritative sources. These data have been carefully checked and are believed to be approximately correct.

FIG. 4

I realize that this expanded production is "viewed with alarm" by many in the industry, but the paper industry is and has been expanding, and new uses for wood pulp are constantly being found. The list of paper articles which have come into household and private use since the beginning of the century is indeed a long one. It includes such articles as paper towels, napkins, facial tissues, drinking cups, plates, etc. and this list can be extended almost indefinitely.

In this country the production of all grades of container and boxboards has grown from 3½ million tons in 1927 to 5¼ million tons in 1936. "The new capacity coming in will about balance off the normal growth in demand***over the long pull new capacity is not overproduction, it is necessity". (Alan G. Goldsmith in *Fibre Containers*, 22; No. 6: 14, June 1937).

Building and insulating boards have graduated in many cases from using waste wood to pulp wood as the raw material.

The future will undoubtedly see a larger use of paper and boards in conjunction with artificial resins and plastics, however, the textile trade is the greatest tonnage competitor for cellulose. In 1936 the world produced a billion pounds of rayon yarn, and about 300 million pounds of staple fiber, Japan being in first place, closely followed by the United States, then Italy, Germany, Great Britain and France. The total production of these artificial fibers was 651,581 tons, but as it requires about 1.2 tons of sulphite pulp to make a ton of rayon yarn, the actual pulp consumed in this industry would amount to 782,000 tons. The production of staple fiber has more than doubled itself for three years in succession. The use of staple fiber is rapidly expanding, especially in countries which have to buy most of their cotton and wool. Regulations are in force in some countries compelling mixtures of staple fiber with cotton and wool in many fabrics, and in others exemption from textile consumption tax is granted to encourage the production and use of staple fiber.

New Uses for Cellulose

The production of cellophane and similar transparent wrappings has reached large figures, but I have been unable to obtain accurate world statistics.

Almost all of our seemingly new cellulose products have a lengthy historic background. The story of some of these developments make most interesting narratives, but in this paper I can only mention a few. Cellulose acetate has consistently been making deep inroads into the uses and application of cellulose nitrate. The acetate derivative possesses most of the properties of the nitrate and is less inflammable. With rapidly declining production costs, and a wider range of relatively low priced solvents, and plasticizers giving it thermoplastic properties, it now occupies a premier position as a material for the manufacture of films and sheeting from a thousandth of an inch or less to slabs of an inch or more thick.

Cellulose ethers are now appearing on the market as a material for the manufacture of both sheeting and molded products. Ethyl and methyl cellulose are now available in commercial quantities, and benzyl cellulose will follow if the demands of the trade warrant it. These products are unique in many respects and will fulfill the requirements for certain applications for which most other compositions are unsuited. They are exceedingly tough, of high tensile strength, transparent, readily plasticized, and thermoplastic. They dissolve in a large number of solvents including the low priced aromatic hydrocarbons, and are compatible with most fatty oils and resins, and even waxes.

Alkali soluble cellulose ether for permanent sizing of textiles has been hailed as the "finish of the future". This use of cellulose ethers is only in its initial stages, but promise to grow to large proportions. (See paper by Wallace P. Cohoe, *Chemistry and Industry*, 56: No. 17: 381, April 24, 1937).

In the lacquer industry the bulk of the cellulose raw material is still derived from cotton linters, and this is true in the allied explosive field.

It is impossible to predict the course of this competition of newer cellulose products for the raw materials on which the paper industry considered it had a monopoly. This is especially true with the present rapidly changing world conditions, but in the paper industry of the industrially more advanced countries of Europe and North America it appears likely that the raw materials at present in use will continue to be available and will have to be relied upon to meet future requirements. New raw materials are, however, continually being suggested and tried, but they do not displace or compete directly with those already in use. The paper industry is now so developed and specialized that it is not easy for a new material to be introduced and established. To stand a chance a new raw material must meet a number of rigid specifications and do so fairly obviously before a manufacturer would take the risk of adjusting his mill operation to meet the conditions required by the new raw material. If a new material is to survive its industrial birthday it has to do so in a mill where the machinery and processing have been designed and adjusted for other materials, and overcome prejudice on the part of the worker against anything new.

As a matter of fact no new raw material of any real importance has appeared since esparto and chemical wood first came into use between 1860 and 1880.

"Although this is true it is not the whole truth of the matter. The spread of education and communication are now rapidly bringing new countries into the web of modern civilization and there are millions in tropical countries who desire not only to read and write, but to enjoy the power, economic and political, which they believe to be derived from industrialism. These countries will make use of local raw materials and devise methods of using them. Behind high tariff walls cheaper grade products suitable for local requirements are being produced and will be produced in ever increasing quantity. It is clearly a gain to the whole world that regional industries should thus spring up to make use of low grade materials for the manufacture of paper products which will not stand high freight rates. The supplying of local demands with local products will eventually stimulate a subsequent demand for better grades which will be met with by supplies from the more advanced countries. This has happened already in other industries." (See paper by C. J. J. Fox, "Advances in the Chemistry of Cellulose," Proceedings Technical Section Paper Makers' Association of Great Britain & Ireland, Vol. 12, Part 1, October, 1931).

In the paper industry the conditions are such that

in countries like India, Burma, Java, West Indies, Brazil and some Central and South American countries, economic production is now quite feasible on a technically satisfactory scale. In India the use of bamboo has grown to respectable proportions.

Predictions for the United States

For this country then it is reasonable to predict that we shall see:—

New sources of raw material supply becoming commercially accessible.

New raw materials coming into use.

New processes being developed to use existing raw materials not easily utilizable by present processes.

More extensive use of waste paper.

Greater use of agricultural wastes for special grades.

Increased efficiency and economy in our pulp and paper making operations.

Better forest management. Recognition of our forests as national assets to be preserved and managed efficiently whether privately or publicly owned. That vast resources are valuable in proportion as they are intelligently and scientifically used.

Reburning Lime by the Nichols Herreshoff Furnace*

By K. A. Forrest[1]

Abstract

A description of the mechanism and operation of the Nichols-Herreshoff furnace for reburning lime for making caustic liquor in kraft pulp mills.

This paper is written with the purpose of presenting the Nichols-Herreshoff furnace to the paper industry and to show how it is adaptable and suited to the practice of reburning lime for the production of caustic liquor in paper mills.

Inasmuch as this type of furnace is probably unknown to a great many in this field a brief history and mechanical description of the furnace will be necessary for a proper understanding of the operation as will be discussed later in the paper.

The data contained in this paper pertaining to the operation in making lime is a result of a comparatively short period of observation and collection of facts. For this reason then it may be that temperatures, etc. given may be found to be changed at some later date to insure better operation.

History

The Nichols-Herreshoff furnace was originally developed in the ore smelting and sulphuric acid industry for the continuous treatment of table or flotation concentrates, i.e., it was especially developed for the treatment of fine material. Other furnaces of this type are the Wedge, the Evans-Klepetko, and the Skinner.

The Herreshoff furnace has been in use for a number of years in metallurgical processes and enjoys considerable popularity.

It is only in the last few years, however, since the development of high temperature resistant castings that it has been possible to use this furnace for high temperature calcining such as is necessary in reburning lime.

Mechanical Principles

The furnace is a vertical, brick lined iron or steel cylinder having from six to twelve superimposed hearths. There is a central rotating shaft which carries radial stirring arms having blades (or teeth) set at the proper angle for stirring and moving the material.

This design then results in distributing the raw material in circular windrows of comparatively small size exposing the maximum amount of surface to the "air" for oxidation and removal of waste gases and continually advancing these windrows until the finished material is discharged.

The speed of travel of the material through the furnace is determined by the horizontal length of the teeth and the revolutions per minute of the central shaft. This is all predetermined by a consideration of the character of the raw material and resultant desired product.

The furnace is of multiple hearth construction with a central shaft supporting the arms to which rabble teeth are attached. The shaft is cooled by low pressure air and revolves at the rate of one revolution per minute.

The top of the furnace is of fire brick, self supporting and is called the drying hearth, from which the material is fed through three drop holes to the furnace proper.

Each hearth has six working doors 19 x 14 inches and of machine fit with a 4 x 1 inch peep hole with cover in each door for scanning purposes.

The four bottom hearths have six Surface Combustion high pressure burners of the two-stage type to each hearth and the three upper hearths and three burners to each hearth.

The four bottom hearths each have two rabble arms of "pyrocast" cast iron with teeth of same material.

The upper four hearths have four arms to each hearth. Teeth and arms are of standard cast iron.

The arms are attached to the central shaft by slipping into a socket in the shaft and held in place by a vertical pin through a projection on the shaft into a hole in the arm. The teeth are attached to the arms through a dovetail slot running lengthwise of the arm and are retained by means of two pins in the end of the arm.

* Presented at the Fall Meeting of the Techincal Association of the Pulp and Paper Industry, De Soto Hotel, Savannah, Ga., Oct. 18-21, 1937.

[1] Member TAPPI, General Manager, Crossett Paper Mills, Crossett, Ark.

This construction of the arms and teeth is to allow for removal or change of either the arms or the teeth from any of the six working doors on each hearth without the necessity of cooling the furnace appreciably.

The shaft and arms are air cooled. This is accomplished by constructing them with an annular wall in such a manner that the cooling air is forced through the central part of the shaft and is tapped by the arms through steel tube cast into the arm and carried to the end of the arm where it returns inside the outer shell of the arm to the outer shell of the shaft and thence to exit stack.

The hearths in succession from top to bottom are alternately what is commonly termed "in" or "out" hearths, i. e., and "in" hearth is one on which the material is moved toward the center and is so constructed that it ends about two and a half feet from the shaft to allow material to drop to next hearth which is an "out" hearth upon which the material moves toward the periphery and passes thru drop holes spaced around the periphery unto the next hearth which is an "in" hearth, etc. until the material is discharged from the last hearth which is an "out" hearth.

Numbering the hearths successively from bottom to top the odd numbered hearths are "out" and the even numbered hearths are "in".

Operation of the Furnace

Starting Up The Dried Furnace

When starting a cold furnace before any heat is applied be sure that the furnace mechanism is in good order and the central shaft will revolve without binding at any point. Before power is applied it is advisable to rotate the central shaft (by hand) one complete revolution to insure that everything is in the clear.

All hearths should be inspected and rabble teeth put in place on each arm.

All doors on the furnace should be closed except on the top hearth. At least four doors on this hearth should be left open.

The next step is to start the motor that drives the furnace. As soon as this is done the gas burners on the bottom hearth (No. 1) can be lighted, using a kerosene or fuel oil torch for this purpose. Keep a record of temperatures on each hearth and do not allow the temperature to rise more than *20 degrees F. per hour for the first 24 hours.*

After the first 24 hours additional burners on hearths 5, 6, & 7 can be lighted and the temperature raised at a rate of *30 degrees F. per hour* for 24 hours.

As soon as 48 hours have elapsed and the temperature has been raised according to the above procedure, the temperature can be raised as fast as desirable without damage to the furnace.

The air cooling fan for the central shaft and arms should be started after the first 24 hours keeping shaft air temperature *below 480 degrees F.*

Shutting Down

The same procedure is advisable in shutting down as in starting up but reversing the operation.

Normal Operation

After the above procedure has been carried out the furnace is raised to temperatures on each hearth that it is intended to maintain during operation. The feed may then be started.

As soon as normal feed is coming through, gas adjustment will have to be made to maintain the desired temperature.

If the furnace has to be stopped for any reason the feed to the furnace should be stopped. If feed from filters has to be shut off the gas should be cut down to prevent over burning the lime.

Broken Rabble Arms and Teeth

To install a new arm move the central shaft by hand so that the rabble socket is in direct line with a working door. Then place the special carriage through the door and hook the end over lugs on each side of rabble pocket on central shaft.

Special Consideration

The drying hearth in the burning of the lime does not serve to dry the material before going into the furnace proper as would be indicated from the name but acts more as a conditioner of the material. The reason for this is the higher per cent of moisture in the feed (averaging about 35 per cent).

Ideally the feed from the filters should be a "dry" cake with just enough excess water to cause it to roll up in balls before dropping through to No. 8 hearth. The material in this condition will keep this form to a great extent throughout the travel through the furnace.

This condition though is a direct result of the operation in the causticizing plant. Thus a fluctuation of any magnitude in operation in causticizing plant reflects directly in filter operation.

It is sufficient for the purpose here to say that the material is too often too wet or too dry. If it is too wet there is at present no adequate means of changing it after it leaves the filters as the drying hearth does not carry sufficient heat to drive off excess moisture. If it is too dry it can be remedied by addition of sufficient water directly to drying hearth to make the cake ball up.

The material being excessively wet will generally cause no trouble until it gets literally soupy. This soupy condition has the tendency of causing the material to finely divide upon drying in the furnace and will act almost like water in that it has a decided tendency toward "flowing" and is almost impossible to move by rabbling as it will "flow" right back from where the rabble pushed it. This condition can be partially corrected by increasing the temperature on the top three hearths and wholly corrected by reducing the per cent moisture in filter cake.

A too dry condition on the drying hearth has the tendency of making the material "mealy" throughout its travel and while it produces an excellent lime has the disadvantage of sticking to the rabble teeth piling up in front of the arms. This is controlled by addition of water to the drying hearth as note above.

In connection with the above, however, it should be said that these conditions will vary to a considerable extent and the proper control cannot be maintained without a careful study of contributing factors to each condition. Furthermore, these conditions will only follow in a general way in different plants and each must be made a subject of separate study in its own particular situation.

The behavior of the material after getting inside the furnace is entirely a matter of temperature control under constant feed conditions with a nominal consideration of chemical composition although this

last is not particularly important as the raw material is preponderantly of a uniform chemical composition under normal conditions of operation. Even variations of feed will not affect the behavior of the material providing the feed does not exceed the capacity of the furnace to handle.

Temperature control in these furnaces is a great deal more exacting than it is in other lime burners. This is not only true with regard to the quality of the product but also with regard to the physical behavior of the material.

Temperature Control

Temperatures as given are general and cover most fluctuations. References in this section to temperature change means that for conditions as mentioned the temperature is either too high or too low as given and consequent changes are then indicated with reference to temperature to control behavior.

Remembering that the hearths number from the bottom to the top the following is a discussion of temperature control.

Theoretically calcium carbonate loses carbon dioxide at 1517 deg. F. Then it would follow that providing we could keep the material in the furnace at 1517 deg. F. and for a sufficient length of time we would be able to drive off all the carbon dioxide. Practically though it is obvious that this cannot be done as a prime consideration is time and as the speed of reaction is dependent on temperature, the temperature then must be raised to a point that will drive off all the carbon dioxide possible during the time of travel through the furnace. This time of travel is approximately three hours. Then through actual operation we find the following temperatures on their respective hearths will give a product of a high quality with no "burning" and no cores.

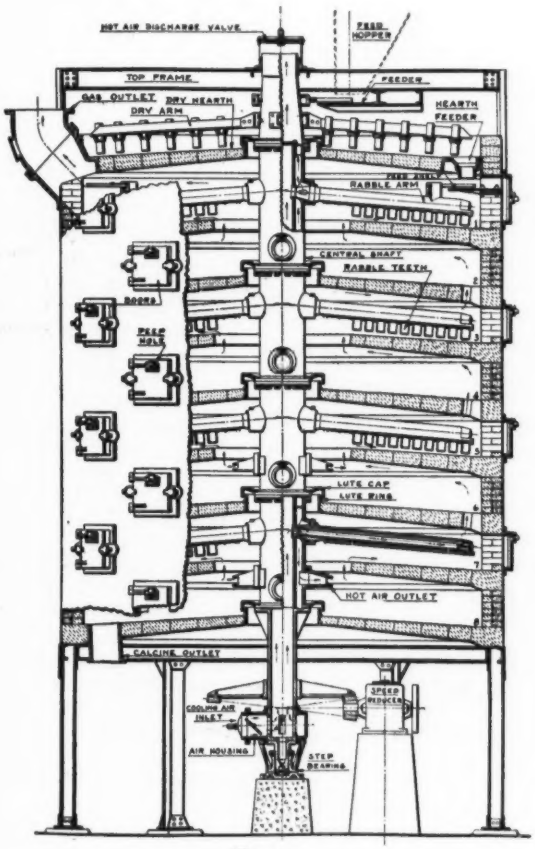


FIG. 1.
Cross Section Standard 8-hearth furnace

No. 8 hearth is preferably carried at 1200 deg. F. plus. This temperature serves the dual purpose of keeping the drying hearth hot and nearly finishes the initial drying of the material. The bulk of drying must be done here.

No. 7 hearth is carried at about 1300 deg. F. which drives off the last remnant of moisture and gets the material thoroughly hot. A lower temperature allows moisture to carry to No. 6 hearth.

Unless the material has lost all its moisture before reaching No. 6 hearth the temperature here of 1400 deg. F. plus causes it to smell like popcorn and being on an "in" hearth does not move as rapidly as it has to move up hill which results in jamming and a consequent reduction in feed until the trouble is cleared up and the temperatures are raised to a point which will insure that the material will go through the smelling stage partly on No. 7 hearth which is an "out" hearth.

On No. 5 hearth the actual calcination begins with a temperature of 1500 deg. plus. The reason that it starts here rather than on No. 6 hearth which is approximately the same temperature is due to the fact that while No. 6 records 1500 deg. the actual temperature of the material is actually somewhat less while on No. 5 the temperature recorded is more nearly correct with respect to the material itself.

On Nos. 4 and 3 hearth the temperature ranges between 1600 deg. F. and 1700 deg. F. depending upon the quantity of material passing and the analysis of the discharge. No trouble is experienced with these hearths as regards the behavior of the material.

On No. 2 hearth the temperature is kept at from 1700 to 1750 deg. F. and on No. 1 hearth from 1800 deg. F. plus. These two hearths act more or less as a unit and will be considered together. The final calcination takes place here and the analysis of the final product is controlled here. At least that is the assumption at the present time. However, it is known that the temperatures here are in direct relation to the temperatures and behavior, temperature, load relative is not definitely known as yet this phase will be a matter of further study.

What is known though is that the condition of the material on the drying hearth governs the temperatures carried through the furnace and particularly on Nos. 1 and 2 hearths. If the material is finely divided resulting from too wet feed it can be carried about 1875 deg. F. With a mealy condition both Nos. 1 and hearths are carried at the minimum as mentioned above. And with a balled condition the temperatures on Nos. 1 and 2 are carried at the maximum mentioned.

Also if the temperatures on these two hearths are carried too high for the condition of the material discharged product is of a lower quality than it would be if carried at a lower temperature.

It was intended to include a heat balance, but this information is not yet available due to the comparatively short period of operation.

Effect of the Viscosity of the Grinding Medium in the Mechanical Pulping Process*

By E. R. Schafer[1] and J. C. Pew[2]

Abstract

Grinder runs at the Forest Products Laboratory have been made at various pit temperatures with water as the grinding medium and also at various pit temperatures in which the normal viscosity changes of the water have been offset by the introduction of appropriate quantities of cane sugar. When a normal consistency of pulp is maintained constant, an increase in pit temperature results in longer-fibered, stronger pulps at decreased energy consumption. These effects tend to diminish when a fixed viscosity accompanies an elevation in temperature, indicating that viscosity changes, in part at least, are responsible.

Previous publications by the Forest Products Laboratory *(1, 2)* have shown that an increase in grinder pit temperature is advantageous in producing longer-fibered, stronger pulps, generally with lower energy consumption and higher grinding rates. It was further indicated *(2)* that the softening of the wood structure, occasioned by the higher temperatures, was not the only factor in bringing about these results and it was suggested that the change in viscosity of the water serving as the grinding medium might play an important role. To study this, in the present work grinder pit temperatures were varied but the viscosity held constant by the introduction of appropriate quantities of cane sugar into the water.

* Presented at fall meeting of the Technical Association of the Pulp and Paper Industry, DeSoto Hotel, Savannah, Ga. October 18 to 20, 1937.

[1] Member TAPPI, Engineer, Forest Products Laboratory, U. S. Forest Service, Madison, Wis.
[2] Member TAPPI, Associate Engineer, Forest Products Laboratory.

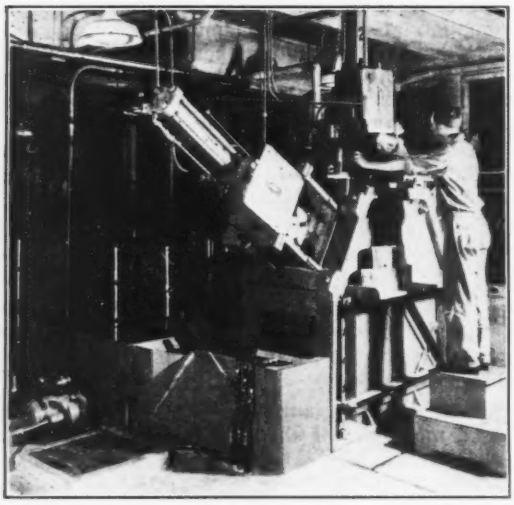


FIG. 1.
Side and front view of experimental grinder showing screen and underground stock tank in foreground and grinder motor and transmission in background.

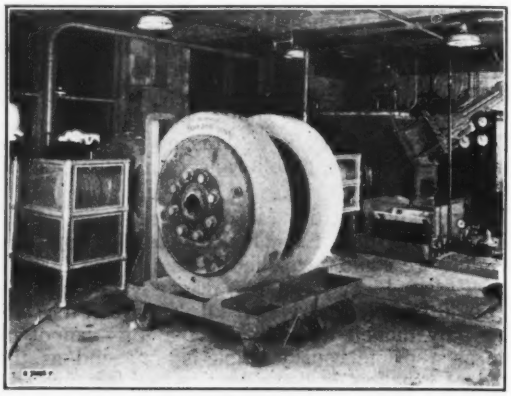


FIG. 2.
Rear view of experimental grinder showing spare pulpstones in foreground, and control instruments in background.

Equipment and Experimental Procedure

GRINDER EQUIPMENT

The experiments were made on the recently in-

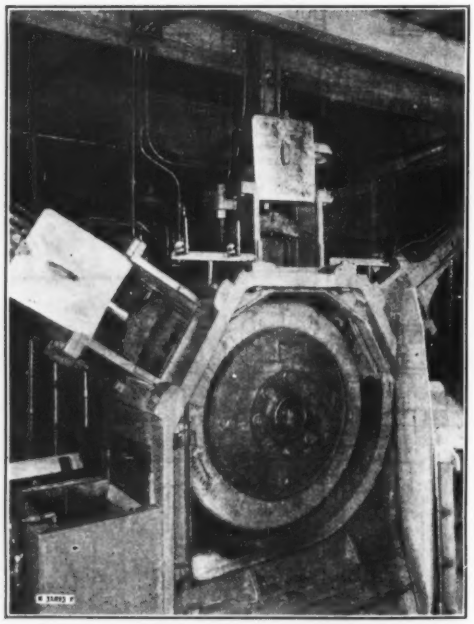


FIG. 3.
Front of experimental grinder with door open showing pulpstone and monelmetal lined grinder pit.

stalled experimental grinder which has been previously described *(3)*. This grinder is, in effect, a commercial machine of reduced width, the stone being 54 inches in diameter and the pockets 16 inches wide. The face of the stone has, however, been reduced to 8 inches for grinding wood bolts 6 inches long. Pressure is applied by means of oil hydraulic cylinders. Automatic control has been provided for both grinder pit and shower-water temperatures. Figs. 1, 2, and 3 show the grinder and controls. A segmental grindstone of Crystolon abrasive, grit size 3760/5, grade N7, was used for the experiments, this being a grade used commercially in newsprint mills. A 10-cut, 1½-inch lead spiral burr was applied and the stone surface worn in by 12 hours of grinding before starting the experiments.

Wood Used

A number of spruce logs, free from large knots were squared to 4.8 inches on a side and cross-cut to 6 inches in length. The several batches of wood used for the experiments were made up by taking one bolt from each log. Selected in this manner, the wood for the various runs was nearly identical in properties. The wood was stored in closed containers at 38 deg. F. until shortly before grinding.

Grinding Solutions

Isotherms of sucrose solutions relating concentration to fluidity (reciprocal viscosity) are shown in Fig. 4. The points shown indicate the concentrations and temperatures for the several grinder runs made in these experiments. Thus a grinder run was made at 160 deg. F. with water and then repeated at 190 deg. F. using a 9.5 per cent sugar solution which has an equivalent viscosity. Similarly the viscosity of water at 130 deg. F. was duplicated by using a 10.3 per cent sugar solution at 160 deg. F., and 18.5 per cent at 190 deg. F. In addition a run was made with an 18.5 per cent sugar solution at 130 deg. F. to study the effect of higher viscosities. The viscosity at this concentration and temperature is equivalent to that of water at 82 deg. F. A run was also made with water at 190 deg. F. to compare the effect of a high

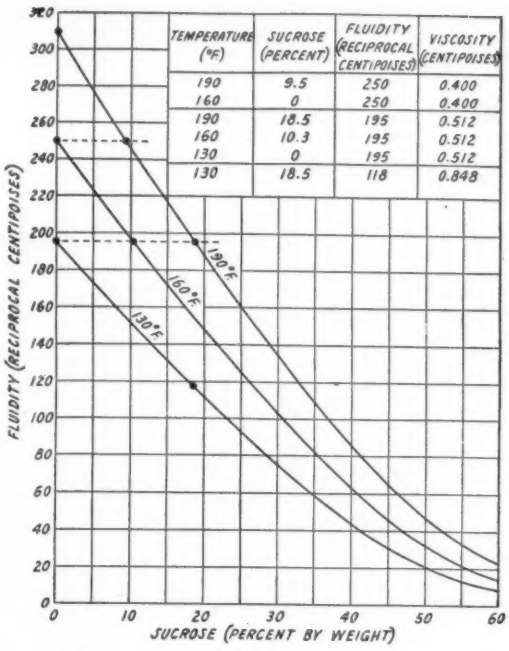


FIG. 4.
Isotherms of Sucrose Solutions Relating Fluidity to Concentration.

TABLE I.—EFFECT OF VISCOSITY IN THE GRINDING OF SPRUCE[1]

	Grinding conditions[2]							Properties of pulp suspension							Properties of pulp test sheets			
		Shower water						Screen Analysis										
									Retained between									
Grinder, Run No.	Pit temperature, deg. F.	Sucrose content, Per cent by weight	Viscosity at pit temperature, Centipoises	Consistency[3], Pounds pulp per gallon of suspension	Energy consumed, H.p. days per ton wood ground	Power input, H.p.	Grinding rate, Tons dry wood per 24 hours	Freeness Schopper Riegler, Cc.	Retained on 24 mesh, Per cent	24 and 42 mesh, Per cent	42 and 80 mesh, Per cent	80 and 150 mesh, Per cent	Passing 150 mesh, Per cent	Average screen opening of pulp[4], Mm.	Burst, Per pound per ream, 25 by 40 by 500, Points	Tear, Per pound per ream, 25 by 40 by 500, Grams	Tensile per square inch, Pounds	Solid fraction
Series 1—Varying temperature with normal change of viscosity of water																		
304	130	0	0.5115	0.28	55.6	86.9	1.56	328	5.4	10.2	16.4	16.9	51.1	0.084	0.28	0.64	1,925	0.33
302	160	0	.4000	.30	53.0	82.9	1.56	330	11.2	10.9	15.8	14.9	47.2	.089	.28	.75	1,900	.33
307	190	0	.3229	.30	50.2	79.1	1.57	380	18.6	11.9	15.4	13.2	40.9	.102	.35	.83	2,082	.32
Series 2—Varying temperature with constant viscosity																		
304	130	0	.5115	.28	55.6	86.9	1.56	328	5.4	10.2	16.4	16.9	51.1	.084	.28	.64	1,925	.33
301	160	10.3	.5115	.30	58.7	79.3	1.35	317	9.0	10.5	15.4	12.9	52.2	.084	.30	.72	2,010	.33
305	190	18.5	.5115	.34	50.7	79.6	1.57	442	12.6	10.2	14.0	12.9	50.3	.087	.28	.66	1,520	.30
302	160	0	.4000	.30	53.0	82.9	1.56	330	11.2	10.9	15.8	14.9	47.2	.089	.28	.75	1,900	.33
306	190	9.5	.4000	.31	50.8	77.3	1.52	387	14.9	11.1	15.2	13.4	45.4	.094	.29	.74	1,770	.30
Series 3—Varying viscosity at constant temperature																		
304	130	0	.5115	.28	55.6	86.9	1.56	328	5.4	10.2	16.4	16.9	51.1	.084	.28	.64	1,925	.33
303	130	18.5	.8547	.26	58.7	79.2	1.35	401	2.9	7.7	13.1	13.7	62.6	.073	.30	.57	2,054	.34
302	160	0	.4000	.30	53.0	82.9	1.56	330	11.2	10.9	15.8	14.9	47.2	.089	.28	.75	1,900	.33
301	160	10.3	.5115	.30	58.7	79.3	1.35	317	9.0	10.5	15.4	12.9	52.2	.084	.30	.72	2,010	.33
307	190	0	.3229	.30	50.2	79.1	1.57	380	18.6	11.9	15.4	13.2	40.9	.102	.35	.83	2,082	.32
306	190	9.5	.4000	.31	50.8	77.3	1.52	387	14.9	11.1	15.2	13.4	45.4	.094	.29	.74	1,770	.30
305	190	18.5	.5115	.34	50.7	79.6	1.57	442	12.6	10.2	14.0	12.9	50.3	.087	.28	.66	1,520	.30

[1] The wood, selected from shipment 1,480, had an average density of 25.8 pounds dry wood per cubic foot green volume and an average dryness of 67 per cent.
[2] Constant conditions were: Stone, Crystolon abrasive with grit 3760/5 and grade N7 dressed with 10-cut 1½-inch lead burr and in service 12 hours before experiments were started; pressure of wood against stone, 50 pounds per square inch (not corrected for friction losses in piston and gland); speed, 3,150 peripheral feet per minute. The variations in consistency during a run were the same in all runs. See note 3.
[3] Average value for entire run. A variation in consistency from 0 to the maximum occurred during the first half of the run. The consistency during the last half was at the maximum.
[4] Calculated from the screen analysis. A function of the average fiber length of the pulp.

temperature and low viscosity. Although the mean temperature at the wood-stone contact is somewhat above that of the pit, the viscosity relationships at this point would be approximately proportional to those in the pit since in the range of the experiments the isotherms are nearly linear and parallel.

Method of Operation

In order to minimize the amount of sugar required, the grinder runs were made as short as practicable. A single pocket of wood was ground in each case using three of the 4.8-inch square blocks along the width of the pocket and four in height. This amounted to about 24 pounds of dry wood. The stone was heated to the desired temperature with hot water, the pit drained, and half of the sugar solution run in. The solution was brought to the proper temperature by passing steam through a coil in the pit. Grinding was then started and the temperature of the pit maintained constant by passing cold water through the pit coil. When half the wood was ground, the consistency attained was about 0.3 pound of pulp per gallon of suspension. The rest of the sugar solution was then admitted through the shower system as needed to maintain the desired temperature in the usual manner for grinders equipped with temperature control systems. During this latter stage it was necessary to adjust the temperature of the shower solution or to heat the pit with indirect steam in order to maintain the same consistency from run to run. The pulp passed from the grinder through a rotary-type sliver screen into a tank where the suspension was thoroughly mixed and sampled. The sample was run through a small diaphragm screen equipped with a 12-cut slotted plate and dewatered on a suction filter. Pulp tests were made according to the May 1937 revision of Method No. 96[3].

[3] Manual of Standard Forest Products Laboratory Testing Methods for Pulpwood, Pulp, Stuff, and Paper.

Discussion of Results

For convenience in study the results have been grouped in Table I into three series. In series 1, in which the temperature was varied without controlling the viscosity, the effects noted are much the same as in experiments previously reported. Increased pit temperature resulted in decreased energy consumption, increased fiber length, increased bursting and tearing strength, and increased freeness. The grinding rate, however, remained constant.

In series 2 an increase in the temperature under two constant viscosities again resulted in decreased energy consumption, but fiber length increased less than when the normal viscosity drop was allowed to occur, and the freeness increased more. Bursting and tearing strengths remained constant with increase in temperature while tensile strength dropped.

In series 3 the effect of varying the viscosity under three constant temperatures was noted. Increased viscosity at constant temperature resulted in shorter-fibered pulps with either an increase in power consumption or a decrease in strength.

It has been assumed in this work that the only effect of adding sugar to the grinding water was to increase its viscosity at a given temperature. Surface tension, hydration, or other factors may be involved, but it is believed that at the concentrations employed the viscosity was the predominating influence.

From the results obtained it seems evident that the beneficial effects produced by grinding at high pit temperatures are due to the lowered viscosity of the grinding medium as well as to the softening of the wood.

Literature Cited

(1) Schafer, E. R. and Pew, J. C. "Effect of Temperature and Consistency in Mechanical Pulping," *Paper Trade* 101, No. 13; 71-76 (Sept. 26, 1935). *Tech. Assoc. Papers* 19: 401-406 (June, 1936).
(2) Schafer, E. R. and Pew, J. C., and Knechtges, R. G. "Effect of High Pit Temperature and Preheating of the Wood on the Grinding of Loblolly Pine," *Paper Trade* 103, No. 2; 29-32 (July 9, 1936). *Tech. Assoc. Papers* 19: 279-282 (June, 1936).
(3) Schafer, E. R. and Pew, J. C. "An Improved Pulpwood Grinder for Experimental Work," *Paper Trade* 100, No. 25; 19 (June 20, 1935). *Tech. Assoc. Papers* 18; 144 (June, 1935).

Pulp Bleaching Under Ultra Violet Light*

By W. Hirschkind in collaboration with D. J. Pye and E. G. Thompson[1]

Abstract

A review of Escourrou's theories of the effect of ultra violet light on the bleaching reaction in pulp and a report of tests made to determine the optimum condition of using such light.

Since time immemorial, vegetable fibers have been bleached by exposure to sun and air. For many centuries this method remained the only form of bleaching.

The discovery of chlorine in 1774 and that of hypochlorite in 1789 provided means to bleach fibers in hours where formerly weeks and months had been required.

In the bleaching of pulp, hypochlorites, particularly calcium hypochlorite, remained for many years the principal reagent, the reaction being partly one of oxidation, partly as Cross and Bevan demonstrated one of chlorination in the direct formation of lignin chloride. Both reactions go on simultaneously without any attempt to control either, often resulting in the hydration of cellulose and thereby weakening the final bleached material. Some ten years ago it was found possible to split up these two reactions. In the first part the residual lignin in the pulp is rendered soluble by direct chlorination and removal of the chlorinated lignins by washing. Subsequently the remaining color is removed by oxidation in a treatment with calcium hypochlorite. The latter process called, "multi stage bleaching" has been made subject to many modifications. Temperature, pH, quantity of chlorine used in the different stages, intermediate treatment with alkalies between stages, etc., have been used depending on the nature of the raw material and on that of the final product. Occasionally additional reagents such as sulphur dioxide and others have been used to advantage in one or the other part of the multi stage bleaching process, but

* Presented by title at the Fall Meeting of the Technical Association of the Pulp and Paper Industry, DeSoto Hotel, Savannah, Ga., Oct. 18-21, 1937.

[1] Great Western Electro-Chemical Co., San Francisco, Calif.

no fundamental change has been introduced since its inception about ten years ago.

Effect of Light

The action of light, which was originally the only source of bleaching, has recently been studied again by a few investigators substituting for the sunlight, that of ultra violet rays. Rene Escourrou (Chimie et Industrie, June 1928) in a very detailed investigation found that ultra violet light increased the color while speeding up the rate of bleaching. However the method resulted in a greater consumption of chlorine with an attack on the cellulose which lowered the yield. Morover, he found that the bleached pulp was rich in oxycellulose, revealed by a considerable increase in the copper number and also in beta and gamma cellulose at the expense of the alpha cellulose content. In his summary Escourrou decidedly advised against the use of ultra violet light in bleaching, especially if the pulp was destined for the manufacture of rayon or other forms of artificial silk.

An experimental investigation by the authors on the use of ultra violet light during various stages of pulp bleaching establishes the conditions under which this interesting means can be utilized to advantage and at the same time explains the reasons for Escourrou's adverse findings.

The investigation covers the wave length of the light source, the optical properties of the cellulose and encrusting substances, the application to different bleaching stages and different pulps and finally the physical and chemical properties of the products. Only a summary is attempted here while details will be reserved for subsequent publications.

Already Escourrou found that ultra violet light greatly accelerates the rate of the bleaching reaction. Hypochlorous acid solution, chlorine water and solutions of hypochlorites were subjected to the action of ultra violet light. The results show that the light is much more effective on hypochlorous acid than on chlorine and that the hypochlorite solution is the most stable under the influence of light. The conclusion drawn from this is that the improved results are due to something other than an increase in the rate of decomposition of the hypochlorite as is the case in the mere catalytic effect of nickel or other metal salts.

We further investigated the comparative value of light during the chlorination and oxidation stage of various chlorine bleaches and determined that light is not effective during the chlorination treatment.

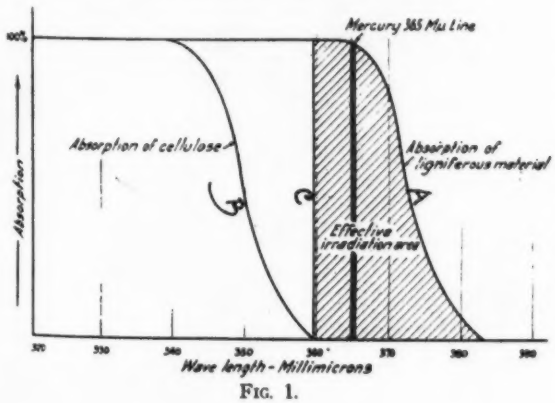


FIG. 1.

This brings us now to a discussion of the optical conditions.

Escourrou used quartz mercury arc lamps which spectra contain rays as low as 180 millimicrons as well as the 365 line. Light from this source applied to the oxidation stage of bleaching of pulp gave a rapid increase in brightness over the sample not irradiated but is accompanied by a very considerable degradation of pulp as evidenced by the reduction in alpha cellulose content and the high copper number. The next step was to narrow the light bands by filtering the mercury arc light through a borosilicate glass such as Pyrex, which eliminates the shorter wave length giving a minimum transmission range of 300 millimicrons. By the use of this filter we were able to maintain the high reaction rate and obtain even higher colors than were possible with the quartz lamp without degrading the pulp. Sulphite and kraft pulp bleached in this manner resulted in substantially higher colors in a shorter time with improvements in physical properties such as mullen, tear and fold and reduction in copper number.

Optimum Conditions

Evidently light rays shorter than about 300 millimicrons have a detrimental effect on cellulose and hence the reason for Escourrou's findings. Beyond 400 millimicrons the visible light present is not of any appreciable value. We consider the range between 350 and 385 to be the optimum.

We further separated the encrusting material or lignin from the cellulose and studied the absorption bands of both materials. Light absorption by cellulose starts at about 350 millimicrons while the encrusting matter or lignin begins at 385 millimicrons. Apparently the near ultra violet light of less energy is sufficient to activate the lignin which is more reactive than the cellulose, but the relatively stable cellulose molecule requires the higher energy of the farther ultra violet light for activation. We have determined that if the light band is restricted to conform with above findings, pulps with superior color may be obtained without degradation.

Different materials may have different absorption characteristics necessitating corresponding changes in radiation so that the reacting constituents can be activated selectively. This is illustrated in Fig. 1 wherein the absorption characteristics of the coloring matter and of a bleached sulphite pulp are shown. The coloring matter absorption is indicated by line A and that of the bleached pulp by line B. To activate the coloring matter selectively while avoiding the degradation of the pulps one should restrict the irradiation so that little, if any, effective radiations below line C are included. Theoretically the only effective radiations for the coloring matter which are not harmful to the cellulose are those included in the shaded area of Fig. 1.

The nature of the process makes it applicable to sulphite, soda and kraft pulps intended for either paper or high alpha cellulose consumption. Samples of bleached pulps have been prepared with physical and chemical characteristics equal to the best of those now commercially produced but with considerably brighter colors.

The foregoing should not be construed as the development of a novel bleaching process, but rather the introduction of a fundamental variable to the art of multi stage bleaching.

Chemical Balance for a Continuous Recausticizing System*

By O. W. A. Rodowski[1] and C. L. Knowles[2]

Abstract

Detailed analysis of losses and distribution of chemicals in the continuous causticizing system.

In the manufacture of kraft pulp approximately 250 to 300 pounds of salt cake must be added to the liquor system for each ton of pulp produced. Any reduction in the amount of salt cake make-up would result in an appreciable reduction in the cost of pulp manufacture. It is therefore of importance to determine accurately where this salt cake goes and where any unnecessary losses occur. Theoretical balance sheets, of course, may be calculated, but they do not give the complete story.

A careful study has been made of the soda balance in the No. 2 Dorr causticizing unit at the Union Bag and Paper Corporation's plant at Savannah, Ga., and it is hoped that the findings may prove of value in an analysis of these soda losses. With the object of obtaining data representative of normal operation in the hands of the regular operating crew, this sampling program was carried out without attempting to influence the operators in any way. It represents a 3 week period in which samples were carefully taken at regular intervals. As brought out in the tables that follow, the indicated total soda loss in this instance is 26.36 pounds of Na_2SO_4 per ton of pulp, equivalent to an overall soda recovery of 98.84 per cent.

Fig. 1 shows the equipment flowsheet of the causticizing plant. Fig. 2 shows graphically the soda balance as determined from the sample data. Soda content at the various points throughout the causticizing system is shown in pounds of Na_2SO_4 per ton of pulp produced. Soda entering the smelt dissolvers from the causticizing system as weak liquor is shown and a soda content value has been assigned to the smelt to include salt cake make-up.

Table I gives the detailed data which is the basis of the soda balance. Table II gives the temperatures maintained at the various points throughout the operation. Table III shows a soda balance summary.

Losses with the dregs in the liquor from the smelting dissolving operation are higher than in the usual continuous causticizing operation. On the contrary, the loss with the bowl classifier [illegible] lower than usual. Na_2SO_4 [illegible] with the filter cake amounts to 25.71 pounds per ton of pulp. While this has been tabulated as lost soda, this is undoubtedly incorrect. Analyses show the total Na_2O content of the lime mud going to the kiln to be the same as that of the reburned lime discharged from the kiln. Theoretically 100 tons of lime mud would produce 56 tons of reburned lime, but when reburning to 78 per cent availability, 100 tons of kiln feed give 72 tons of reburned product. Therefore, it would appear that approximately 72 per cent of the

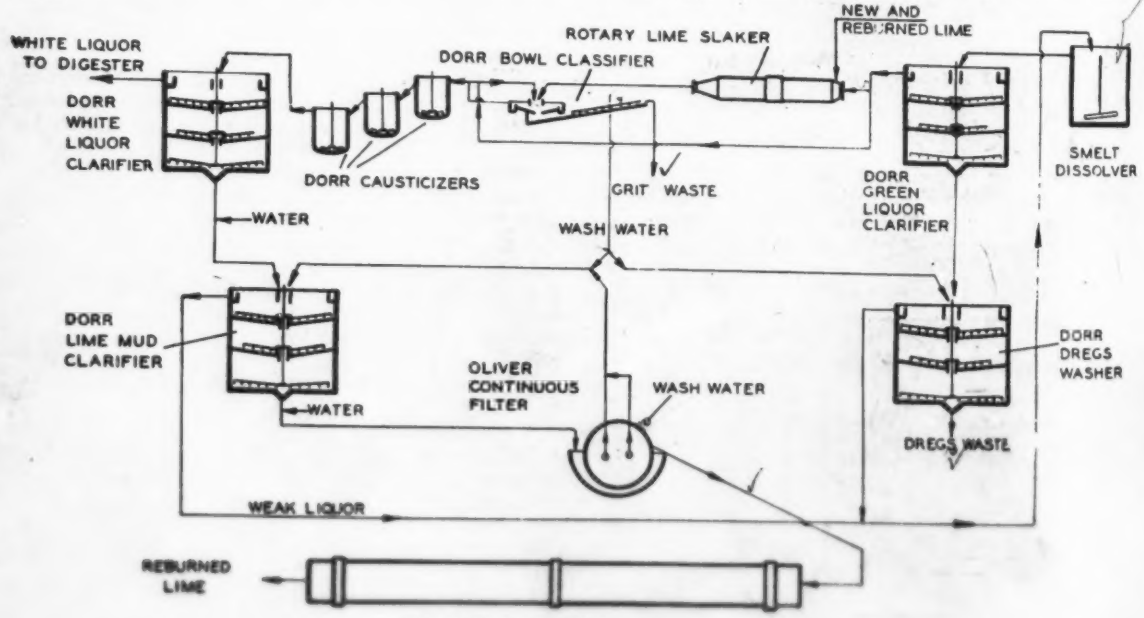


FIG. 1.
Flow Sheet of Dorr Continuous Recausticizing System

* Presented at the Fall Meeting of the Technical Association of the Pulp and Paper Industry, DeSoto Hotel, Savannah, Ga., Oct. 18-21, 1937.

[1] Member TAPPI, Chief Chemist, Union Bag and Paper Corp., Savannah, Ga.

[2] Manager Chemical Division, The Dorr Company, Inc., New York, N. Y.

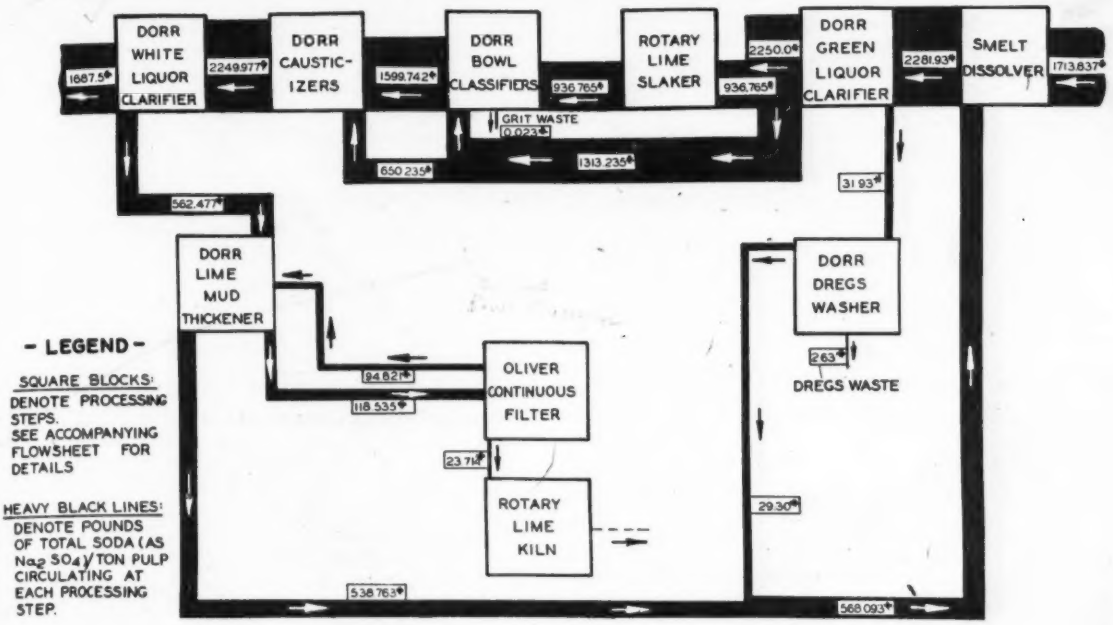


FIG. 2.
Soda Balance of Dorr Continuous Recausticizing System

soda going to the kiln is returned to the slaker and re-used.

G. A. Day (*Paper Trade J.* 105 No. 1:108-110, July 1, 1937), states that some of the soda in the filter cake is insoluble, apparently combined as $Na_2Ca(CO_3)_2$. In checking this, our filtered lime mud showed, on a dry basis, 1.62 per cent water soluble Na_2O and 2.07 per cent total Na_2O. The lime kiln discharge, however, showed 2.07 per cent total Na_2O, all of which was water soluble. This apparently answers Mr. Day's question as to what happened to this soda in reburning the lime. Some of it was insoluble but is regenerated and made usable by

TABLE I

Chemical Balance in a Dorr Continuous Recausticizing System from Tests Conducted at Union Bag & Paper Corporation's Plant during July-August, 1937. Figures shown are requirements for one ton of kraft pulp and are based on 2250 pounds of total soda as sodium sulphate per ton of pulp in the clarified green liquor to the system.

(1) Raw Green Liquor From Smelt Dissolvers		
Volume	118.77	cu. ft.
Total soda as Na_2SO_4	2281.93	lbs.
Insoluble dregs	12.33	lbs.
(2) Clarified Green Liquor From G. L. Clarifier		
Volume	117.116	cu. ft.
Total soda as Na_2SO_4 (19.2118 lbs./cu. ft.)	2250.0	lbs.
NaOH as Na_2SO_4	310.565	lbs.
Na_2CO_3 as Na_2SO_4	1304.38	lbs.
Na_2S as Na_2SO_4	590.083	lbs.
Na_2SO_4 as Na_2SO_4	44.08	lbs.
Dregs to dregs washer	12.33	lbs.
Na_2SO_4 with dregs	31.93	lbs.
Volume of liquor with dregs	1.654	cu. ft.
(3) Dregs Washer Overflow		
Volume of weak liquor	12.48	cu. ft.
Total soda (2.3476 lbs. per cu. ft.)	29.30	lbs.
Volume of wash water added	16.35	cu. ft.
(4) Dregs Washer Underflow		
Weight dry solids to sewer	12.33	lbs.
Volume of liquor to sewer	3.87	cu. ft.
Total soda to sewer	2.63	lbs.
(5) To Slaker—Slaker Operation		
Volume of clarified green liquor (41.634°)	48.76	cu. ft.
Total soda as Na_2SO_4 (19.2118 lbs./cu. ft.)	936.765	lbs.
Weight of inert solids	109.52	lbs.
(6) In Slaker—Slaker Performance		
Volume of water consumed by reaction	2.16	cu. ft.
Volume of water to evaporation	0.196	cu. ft.
Weight of $Ca(OH)_2$ not conv. conversion to $CaCO_3$	666.0	lbs.
Weight of inert solids	109.52	lbs.
(7) Exiting Slaker		
Volume of green liquor	46.204	cu. ft.
Total soda exiting	936.765	lbs.
Pounds of grits raked by classifier	3.97	lbs.
Soda lost with grits	0.023	lbs.
Lime lost with grits	Trace	
(8) To Turbo-Causticizers		
Additional green liquor added	68.356	cu. ft.
Additional soda in above liquor	1313.235	lbs.
Volume of green liquor from slaking	46.108	cu. ft.
Volume of liquor to causticizers	114.56	cu. ft.
Total soda to causticizers	2249.977	lbs.
(9) To White Liquor Clarifier		
Volume of liquor	113.64	cu. ft.
Total soda	2249.977	lbs.
Total suspended solids	924.1	lbs.
Evaporation in causticizers	0.9281	cu. ft.
NaOH as Na_2SO_4	1305.871	lbs.
Na_2CO_3 as Na_2SO_4	331.477	lbs.
Na_2S as NA_2SO_4	562.518	lbs.
Na_2SO_4 as Na_2SO_4	50.104	lbs.
Total soda as Na_2SO_4	2249.977	lbs.
(10) From Clarifier—Overflow White Liquor		
Volume of liquor at 20.0422 lbs. soda/cu. ft.	84.197	cu. ft.
Total soda recovered as strong white liquor	1687.5	lbs.
NaOH as Na_2SO_4	967.533	lbs.
Na_2CO_3 as Na_2SO_4	253.037	lbs.
Na_2S as Na_2SO_4	416.775	lbs.
Na_2SO_4 as Na_2SO_4	50.148	lbs.
Per cent soda recovery as strong white liquor	75.00	
(11) From Clarifer—Underflow		
Weight of suspended solids	924.1	lbs.
Volume of white liquor	28.063	cu. ft.
Total soda	562.477	lbs.
Volume of pulp	36.884	cu. ft.
Suspended solids per cu. ft.	25.0542	lbs. per cu. ft.
(12) To Lime Mud Thickener		
Pounds of suspended solids from clarifier	924.1	lbs.
Total soda from clarifier	562.477	lbs.
Total soda from filtrate	94.821	lbs.
Total volume of pulp	67.433	cu. ft.
Volume of filtrate	30.549	cu. ft.
Volume of water to thickener—as water	65.863	cu. ft.
Volume of water to clarifier underflow	0.103	cu. ft.
(13) From Lime Mud Thickener—Overflow		
Total soda recovered	538.789	lbs.
Volume of weak liquor (at 4.9937 lbs. Soda per cu. ft.)	107.893	cu. ft.
(14) From Lime Mud Thickener—Underflow		
Pounds suspended solids	924.1	lbs.
Total soda in underflow	118.535	lbs.
Total volume of pulp	23.506	cu. ft.
(15) To Filter (From Mud Storage Agitator)		
Total suspended solids	924.1	lbs.
Total soda as Na_2SO_4	118.535	lbs.
Volume of water added—dil'n of l. m. under flow	8.017	cu. ft.

(16) Filtrate—To Lime Mud Thickener		
Volume of filtrate	30.549	cu. ft.
Total soda content (at 3.1040 lbs./cu. ft.)	94.821	lbs.
Volume of water added to filter (showers)	15.437	lbs.
(17) To Kiln—Filter Cake		
Weight of insoluble solids	924.1	lbs.
Pounds of soda as Na_2SO_4	23.71	lbs.
Volume of water in cake leaving filter	12.966	cu. ft.
Filter cake moisture	46.594%	
Volume of water to kiln (dilution)	5.419	cu. ft.
(18) To Smelt Dissolvers		
Weak green liquor	12.48	cu. ft.
Weak white liquor	107.89	cu. ft.
Total	120.37	cu. ft.
Total returned as raw green liquor	118.77	cu. ft.
Volume evaporated in smelt dissolvers	1.60	cu. ft.

the kiln operation. Apparently less than 10 pounds of sodium sulphate per ton pulp are lost in the Dorr system.

TABLE II.—TEMPERATURES THROUGHOUT 210 TON DORR SYSTEM

	Deg. F.
Raw green liquor to clarifier	186
Clarified green liquor overflow	182
Green liquor to slaker, sump tank	193
Slaker discharge	200
Bowl classifier discharge	192
Feed to causticizers	195
Temperature in No. 1 causticizer	195
Temperature in No. 2 causticizer	194
Temperature in No. 3 causticizer	193
Feed to white liquor clarifier	192
Overflow white liquor clarifier	188
Underflow white liquor clarifier	186
Temperature wash water	130
Feed to lime mud thickener	140
Overflow lime mud thickener	135
Underflow lime mud thickener	129

TABLE III.—CHEMICAL BALANCE IN A DORR CAUSTICIZING SYSTEM IN TERMS OF SODIUM SULPHATE PER TON OF PULP

A) Soda Entering as Sodium Sulphate		
Raw green liquor	2281.93	lbs.
B) Soda Recovered as Sodium Sulphate		
As strong white liquor	1687.5	lbs.
As weak green liquor	29.30	lbs.
As weak white liquor (and this includes soda from filtrate)	538.789	lbs.
C) Soda Lost as Sodium Sulphate		
In classifier grits	0.023	lbs.
In green dregs to sewer	2.63	lbs.
In filter cake to kiln	23.71	lbs.
Summary		
(1) Total soda entering	2281.93	lbs.
(2) Total soda recovered	2255.566	lbs.
(3) Total soda lost	26.364	lbs.
(A) Overall soda recovery in green liquor system	99.88%	
(B) Overall soda recovery in white liquor system	98.95%	
(C) Overall soda recovery in Dorr system	98.84%	

It is hoped that this attempt to get some better idea as to where the soda losses occur in the causticizing plant will result in further similar investigations in other kraft mills. Due to acknowledged variations in performance in such operations several such sampling programs may be advisable in any one mill. By coordinating sufficient data, however, a definite line on just when the losses occur will be obtained and then efforts can be directed toward reducing them with resulting saving in soda.

Wood for the Southern Pulp Mills*

The Steps Being Taken by the Industry to Protect That Supply

By Karl A. Swenning[1]

Abstract

The viewpoint of the timber land manager is given regarding the necessity of providing an adequate and sustained timber production to meet the requirements of the pulp industry. Recent efforts toward cooperative effort on the part of the pulpwood and other wood using industries are described.

In the face of all that has been said and written on the potentialities of the southern pineries to produced unlimited quantities of pulpwood in miraculously short periods of time, the question may well be raised as to why the pulp and paper industry need do anything to protect or conserve the available timber supplies. We have read in magazines, in news reports, and even in some technical publications, statements to the effect that a prodigal nature will grow a cord of wood per acre per year in almost any part of the south with the timber reaching a merchantable pulpwood size in from seven to ten years, and this, too, with no effort on the part of man beyond reasonable control of the fire hazard.

The factual data presented by Captain Eldredge, by Mr. Wackerman and by Mr. Hall gives the true story of the problem of pulpwood supply for the existing and planned pulp mills and brings into sharp relief the position of the pulpwood industry in the picture of timber economics in the south. The rapid expansion of the pulp and paper industry within the region has created a highly competitive demand for required wood supplies. That this situation can well lead to economic suicide is a fact apparently recognized by the industry as is evidenced by the steps being taken to protect investments in plants and equipment.

The first, and most logical, step for the industry to take was to obtain control of lands on which stands of pulpwood timber already existed or on which timber might be grown and delivered to plants on a cost basis that would permit the mills to operate on a satisfactory margin of profit. The industry generally has taken this first step though no statistics can be given as to acreage now owned or controlled by individual companies. From data that has been obtained, it is found that present operating mills, under construction and mills definitely announced for construction own or control 3,300,000 acres of timberland with an aggregate stand of 14,000,000 cords of pine pulpwood timber representing an investment of approximately $20,500,000.00. That these figures are not complete is frankly admitted for each week reports are received of additions made to the holdings of individual companies.

It cannot be said that total ownership of stumpage or land is in proper proportion to the anticipated annual wood requirement of over four million cords or that the distribution of ownership by individual companies is in proper relationship to the annual wood use of each operating unit. The fact remains, however, that the industry as a whole has taken the position that some protection of investment through

* Presented at the Fall Meeting of the Technical Association of the Pulp and Paper Industry, De Soto Hotel, Savannah, Ga., Oct. 18-21, 1937.

[1] Mead Corporation, Kingsport, Tenn.

control of at least a part of the wood supplies required is essential.

Sustained Timber Production

That the lands owned or controlled by the southern pulp mills will be scientifically handled and managed on a basis of sustained timber production can be directly assumed but is best evidenced by the trained personnel being retained to put into effect operating plans. Whether properties will be operated with pulpwood as the sole crop or whether they will be handled as multiple use forests producing naval stores, saw logs, poles, piling, etc., are questions for individual managements to determine. Regardless of the end product of the southern pine forest, the management plan must have as its keystone a sound and workable system for fire detection and suppression. As the problem of fire control is one that must be handled through cooperation between private ownerships and public agencies, timberland owners within the industry are endeavoring to coordinate individual plans with such state systems as may be available. That present organizations are inadequate is woefully apparent in all too many localities, but it is hoped that there will be developed in the public mind a proper appreciation of the needs of the situation with public support being accorded state forestry organizations to the end that all forest lands in any region may receive the protection which the investments in permanent southern pulp and paper mills warrant.

It is readily apparent that if all of the lands owned or controlled by the pulp and paper companies are brought to that point of management where each acre is producing the maximum amount of pulpwood, there will still be a large portion of annual wood requirements to be obtained from properties, which for want of a better term, may be called outside ownerships. The industry has recognized that, for the protection of plant investments, pulpwood cutting on these outside ownerships must be conducted on such a basis that these lands too will be kept in continuous timber production.

Southern Pulpwood Association Meeting

The concrete evidence of the recognition of this fact was the conference held at New Orleans in May of this year to which meeting representatives of federal and state forestry agencies, of the Southern Pine Association and of the pulp and paper companies were invited. The announcement of the conference best describes the thought behind the call and is, therefore, quoted.

"The object of this meeting will be to discuss details and formulate a program of forest utilization and conservation which will assure a continuing supply of raw material and to which all can subscribe. The general program to be considered will include three principal subjects:

1. The importance of all pulpwood operations being conducted under such rules of forest practice as will leave the land in the best productive state, and which at the same time will be economically sound and workable for the respective sections into which the southern region may be divided. This statement of importance not only applies to the lands directly under the control and supervision of the ultimate consumer of the pulpwood, but also to all lands from which such consumers obtain their supplies.

2. Conceding the importance of such forest practices over southern pulpwood lands, what means can be employed to effectuate the ends desired?

3. What steps can be taken to assure adequate fire protection on the areas involved in order to preserve the accomplishments obtained?"

That the conference resulted in more than a round table discussion of generalities is evident from the statement of principles upon which an agreement was reached. Those principles were:

1. It is agreed that all land, including non-company land, must be cut over in a manner which will maintain and build up the forest growing stock.

2. It is agreed that each pulp mill operator will employ the necessary qualified personnel to insure proper compliance with agreement No. 1.

3. It is agreed that the southern pulpwood consumers shall be divided into working groups for the purpose of preparing proper regional rules of forest practice.

4. It is agreed that a working committee shall be appointed for each regional group in cooperation with federal and state agencies to formulate and place into effect the cutting procedure for each group in order to carry out agreement No. 1.

5. Agree to satisfy to the fullest practicable extent, the requirements of each mill from improvement cuttings, worked out turpentined timber and salvage from sawtimber cuttings.

6. The industry recognizes that federal and state forest fire protective organizations, as now constituted, are inadequate, and urges their extension and pledges the industry's cooperation in securing more effective forest fire control.

7. The industry agrees to secure insofar as possible the full compliance of its wood producers with the procedure of forest practice as established for each group.

Cooperation of the Pulpwood Industry

Following the New Orleans meeting regional meetings were held at Mobile, Ala., Savannah, Ga., Richmond, Va. and Alexandria, La., to work out and set up rules of forest practice applicable to the timber and operating conditions of the four sections. It may be truly said that the rules agreed upon are not adequate to meet the needs of the situation, but it is believed that those who criticise will admit that this effort on the part of the pulpwood industry toward self regulation is a long step in the right direction. One of the outstanding features of the New Orleans meeting and of the regional meetings was the large attendance of paper company executives and representatives of public forestry agencies. The discussions of problems were notably frank, but friendly, with the paper company officials evidencing every desire to meet the standards proposed by government representatives but holding throughout that the industry was here attempting to put its own house in order without undertaking the responsibility of maintaining adequate timber supplies for other forest using industries or of setting their standards of forest practice.

It is now the plan of the pulpwood industry to hold a meeting of regional committee chairmen to coordinate regional rules and attempt to iron out differences between regional standards of woods practice. In the interim, operating companies are putting into effect the regional rules as accepted and are endeavoring to determine what changes in the rules may be necessary to make them practicable and work-

able. Such changes as are found necessary should very definitely not lower the standards already established, for the increasing demand for pulpwood stumpage makes it imperative that every possible means should be used to build up and perpetuate existing supplies. The industry membership participating in the New Orleans and regional meetings was, it is believed, sincere in its approval of the forest practice rules as written. But a written rule not applied is worse than no rule and compliance by one company and not by another can but lead to a breakdown of this plan of self regulation by the industry.

At this meeting of the Technical Association in Savannah, the center of the naval stores industry, an opportunity is open to view woods operations for the paper industry. With that in mind, it seems proper to acquaint you with the forest practice rules which the pulpwood industry has prepared for application within this region.

"1. Cut worked out turpentine trees and non-turpentine pines.

2. Cut no round or one-faced turpentine trees, except such as are defective or where thinnings are needed.

3. Thinnings may be made so as to leave not less than 50 trees per acre 6 to 9 inches at the stump outside of bark, as well distributed as possible.

4. At least 6 thrifty seed trees per acre shall be left unless sufficient young growth (150 trees 6 to 8 feet high) are present.

5. Clear, clean cutting on restricted areas may be done with the approval of the state forester."

The character of these regulations as related to the major forest industry of this section, namely, naval stores, should be particularly noted. In these rules the primary value of the turpentine pines is recognized and the forest practice rules for use by the pulpwood industry were designed to perpetuate not only the paper industry, but the naval stores industry as well.

In the statement of principles that came out of the New Orleans meeting, section seven provided for compliance with the cutting practice rules by timber operators. To make this effective, several companies have held group field meetings of wood producers where actual demonstration cuttings of pulpwood have been carried out in accordance with the local rules. Other companies have circularized their operating territories with copies of the cutting rules that are to be observed and company employees are being sent to woods operations to check on the observance of the rules by producers. In line with the industry statement of conservation principles, several pulp and paper companies have made public announcement of their forest policies to the end that all may know of the basis on which they hope to make their plants integral and permanent parts of the economic life of their individual locations. Other companies have made or are in the process of making unit or regional studies of available timber stands, the growth, current drain and other factors in order that wood procurement policies may be so formulated that future wood resources may be more, rather than less, advantageously located.

When the pulp and paper industry first looked to the south as a region for expansion, southerners welcomed the industry, feeling that here was the much needed outlet for forest products. As the pulp and paper mills have increased in number and as timber operators without control or thought for the future have clean cut extensive areas of timber, there has been growing in the minds of many people the fear that the paper industry may be the ruination of the south rather than its salvation. To those it may be said that the paper industry recognizes its responsibilities both in the economic and social life of the region. It is believed that given an opportunity to become established the industry will demonstrate its sincerity of purpose and its ability to create a permanent industry, based on continued and continuing supplies of pulpwood. The paper industry alone cannot achieve that end. With it must go a public appreciation of the public responsibility for permanent state forestry organizations to cope with the ever present hazard of fire.

Southern Clays for Paper Making*

By Poole Maynard[1]

Abstract

A review of the progress made in utilizing southern clays in the paper industry.

While practically all of the filler and coating clays produced in the south come from Georgia and South Carolina and while Georgia produces more than fifty per cent of the clays used in the United States for paper making, valuable deposits of white clays are found in Virginia, North Carolina, Alabama, Florida and Texas.

It is of significant interest to paper manufacturers that the wide occurrence of white clays throughout the south, in the coastal plain, the Piedmont Plateau and the Appalachian mountain areas provide an unlimited supply of this raw material, not more than a hundred and fifty miles distant from the Atlantic Coast and much closer to many mills located in the interior.

When it is realized that high grade refined filler clays can be delivered at most any point in the south for less money than the cost of pulp or even a combination of ground wood and pulp, the paper manufacturer may find it highly desirable to use clays in paper products in which they have not been previously used.

The filler and coating clays now being produced in the south are confined to the sedimentary kaolins of Georgia, South Carolina and Virginia. However, with proper refining, there is no reason why the primary white clays of North Carolina, Georgia and Alabama, which are found in the Piedmont plateau and the Appalachian mountain area will not be found adaptable.

* Presented by title at the Fall Meeting of the Technical Association of the Pulp and Paper Industry, DeSoto Hotel, Savannah, Ga., Oct. 18-21, 1937.

[1] Member TAPPI, Industrial Geologist, Atlanta, Birmingham and Coast R.R., Atlanta, Ga.

Slow Technical Development

The development of paper clays in the United States has progressed along the lines of least resistance. Bad roads of a decade ago made costs too high to develop clay deposits that were not in proximity to railway transportation. Until the last decade there was little or no cooperation between the clay producer and the paper manufacturers. The clay producer and the clay broker abhored the clay technologist and everything was blamed on the clay. This attitude prevailed until several of the largest of the clay producers recognized the necessity of technical control, established laboratories and employed technical men to guide them.

It is dangerous for the technologists to make predictions and his only assurance of vindication is to live long enough to see his predictions come true.

The idea of the clay producer was to obtain a clay as white as possible, provided the clay was near a railroad; to obtain a clay that would settle rapidly and would filter press easily, so that the dewatering costs would be low. It made little difference to the clay producer how the clay was dried, as long as it was the cheapest method possible.

To begin with, the colloidal type clays were taboo, they were difficult to disintegrate by methods they used. They would not settle after they were washed, and they would not filter press, therefore in their opinion they were no good. Then when better roads and better auto-trucks were built, the clay producer went eight to twelve miles distant from the railroad in search of clays of whiter color, but still avoiding the colloidal type clays which would not settle or filter press.

Retention Factors

H. L. Bullock in a recent paper entitled "Colloidal Milling Questions and Answers," (Paper Trade Journal—Aug. 19, 1937) tells us—"it is probable that the colloidal condition of the clay is the greatest single factor influencing clay retention. If this is true we can aid retention by the proper milling of the clay."

We do know that only the finer particles present in a clay are really clay particles, the larger particles present are mostly unaltered feldspar and quartz. Fine particles can be obtained by firm grinding and air separation of either a crude clay or a water washed clay, but if the coarser particles are really not clay to start with, it doesn't help matters much to grind them finer.

E. A. Hauser in a recent article entitled "Some Colloidal Aspects of Clay as a Loading Material" (Paper Trade Journal Aug. 12, 1937) says—"The use of loading material as I understand it has the following purposes—

"The clay should fill the open meshes of the loose fiber network and decrease the hardness of the fiber, the water absorption of the paper, etc. To obtain this result the clay must be well anchored to the fiber, so that it does not dust out during printing. It is generally agreed that the smaller the particles the better the anchorage. On the other hand we must realize that a paper pulp that has not been overworked in the beater will result in a fairly open texture.

"To close this texture it seemed so far logical to advocate the use of fairly large size particles. The compromise most generally accepted, therefore, is the application of intermediate particle sizes. Since we have already pointed out that in a properly dispersed and previously purified clay all particles are very much of the same colloidal size, it seems very likely that the present ideas are based more on the size of the aggregates, than on the actual individual particle. The problem should be more that of cementing the fibres together than of merely trying to mechanically fill up the interstices. This clay cementing will largely depend on the hydration properties of the clay and the latter depends on the structure of the clay crystal and on the type and amount of its exchangeable ions, the latter being mainly responsible for the degree of hydration obtainable. If we start with a clay that has been separated from its natural impurities, that has been defloculated or desagregated to a maximum and whose exchangeable cations are known, it must be possible to adjust the process in such a way that a clay of the desired degree of hydration is obtained. Such conditioned clay if precipitated on the fiber by electro-kinetic cementing would not only close the pores satisfactorily, but would also exhibit satisfactory anchorage."

The Paper Clay of Tomorrow

All this is given to illustrate to you that as yet the most desirable clays, for use in the manufacture of paper, in the south have not yet been developed. The paper clay of tomorrow will be from deposits which the clay producer has declared impractical for development because these deposits were not easy to process by old methods.

The processes in vogue today for preparing clays for the paper manufacturer will largely be obsolete tomorrow, they were obsolete twenty five years ago and we technologists knew they were then.

The paper clay of tomorrow will be of good white color composed of clay particles of colloidal size; the clays will be disintegrated in water and pumped to elutriators where the particles, not clay will be separated from the actual clay particle: dewatering will be carried on partially by settling and by the continuous centrifuge now being used for degritting, separation of particle size and dewatering, drying will be carried on partially by settling and by the clay is not altered by too rapid or too high temperatures and then followed by fine grinding.

Such types of paper clays can be obtained from deposits now being developed by the separation of the colloidal like clay, the coarser clays will be used in other markets or ground to a fineness that will meet the filler requirements of those clay manufacturers who will prefer to purchase such clays, and new deposits of these colloidal type clays will be developed.

The sedimentary clays of the south suitable for use in the manufacture of paper are in practically unlimited deposits and have a thickness of from ten to thirty feet or more, with an overburden seldom more than one foot for each ton of clay mined and often the overburden is much less.

There can be no worth while discussion of southern clays without criticism which is meant to be constructive. The fact that the majority of the filler clays and a considerable tonnage of coating clays now used by the paper manufacturers in the United States comes from the south is evidence enough that the southern clay producers are putting on the market excellent clays for paper making, but the advance of technical knowledge has indicated that better clays for the paper maker can be produced.

High Density Vacuum Bleaching of Kraft Pulp*

By Dr. J. Campbell[1] and L. O. Rolleston[2]

Abstract

A brief description of a new patented process of bleaching kraft pulp in a vacuum with chlorine gas.

About 30 years ago the production of kraft pulp was started in the south and since then, due to certain natural advantages, it has increased enormously, particularly in the last year. As the pulp when made into paper was strong and could be produced reasonably cheaply, it was a natural consequence that an endeavor be made to bleach it white and yet retain its initial advantages. Accordingly, the bleaching of the brown kraft pulp was originally carried out in about the same manner as the bleaching of sulphite pulp by using hypochlorite of lime. The results were, however, disappointing, as the strength qualities and color of the bleached pulp were inferior to bleached sulphite pulp.

About 7 or 8 years ago it was found that, if the brown kraft pulp was given a chlorine treatment and then a subsequent hypochlorite of lime treatment with a water wash and alkali cook between the two treatments, a pulp of very much improved strength and color qualities could be obtained. The chlorine treatment of the pulp usually is carried out by passing chlorine gas into a water suspension of the pulp at about 3 per cent consistency: the time it takes to chlorinate the pulp will depend on whether the process is continuous or batch, and may take up to 45 minutes or even more. There are many disadvantages in chlorinating the pulp in this manner and for this reason we have invented an entirely new method which we have called high density vacuum bleaching.

35 to 50 Per cent Consistency

In this new process pulp at a consistency of 35 to 50 per cent is used. Pulp at this consistency may be obtained by means of a screw press or a wet machine either continuously or in form of laps. This pulp is then placed in a suitable vessel which can be sealed tight; a vacuum of about 28 inches of mercury is pulled on the vessel by a vacuum pump. As the vessel is packed full of pulp, there is comparatively little air to be removed; for this reason it only takes from 1 to 2 minutes to obtain the necessary vacuum. In passing it should be mentioned that air is removed not only between the pulp fibers but also inside the fiber walls.

The pulp is now in condition to receive the chlorine gas which is then allowed to enter until say the pressure inside the vessel equals atmospheric pressure. This takes from one to two minutes. It may be said here that the quantity of chlorine added to the pulp may be regulated by the initial and final vacuum in the vessel as well as by the moisture content of the pulp. After chlorination, any excess chlorine in the chlorinated pulp can now be sucked out of the vessel and passed into a vessel containing pulp that has yet to be treated with chlorine. Usually before the vessel containing the chlorinated pulp is opened it is given an air wash for 2 minutes; this removes gaseous products of chlorination such as hydrochloric acid, etc. The pulp can then be discharged for the next stage of the process. There appears to be less hydrochloric acid formed at high consistency of pulp than at low consistency and the hydrochloric acid formed does not appear to have any effect on the pulp. This probably is due to the fact that most of it is in a gaseous state. It also should be noted here that much smaller vessels or tanks can be used in chlorinating a pulp at 40 per cent consistency than at 3 per cent. Also, due to the method of chlorination, the pulp is uniformly treated with chlorine not only on the surface of the pulp fibers but also inside the fiber walls.

In the subsequent stage of bleaching the chlorinated pulp may be washed with water then heated at atmospheric pressure with a caustic soda solution and then given a further double treatment with hypochlorite of lime with a water wash between each treatment

It has been our experience that the vacuum chlorination does not in any way hurt the strength qualities of the pulp, in fact if anything, they are improved. We have also found that with the vacuum chlorinated, hypochlorite method of treating southern pine pulp, we can obtain a pulp equivalent in softness to high grade alpha pulps. This we have never been able to duplicate by means of the usual low consistency water chlorinated pulps, except by a strong caustic soda treatment between the two final hypochlorite stages.

A Process for Semi-Bleached Kraft

In another patented method for bleaching kraft pulp, the slush pulp is treated with an alkali or an alkaline earth salt, the pulp is then brought to a consistency of 40 to 50 per cent, and may now contain about 0.1 per cent of alkali. The pulp is now charged into the high density bleaching equipment and chlorinated. When the pulp is discharged from the chlorinator it will be bleached white. Among other factors, the strength qualities and whiteness will depend on the amount of the small quantity of alkali present. In this process the change from brown kraft pulp to white kraft pulp is only a portion of one minute or about the time the chlorine gas penetrates the vacuum between the fibers. In order to get the highest quality bleached pulp by this process it is preferable to bleach it in stages such as a semi-bleach low bleach and then full bleach. This process is particularly ideal for making a semi-bleached kraft, as the process is simple and practically instantaneous with the minimum amount of chemicals.

* Presented at the Fall Meeting of the Technical Association of the Pulp and Paper Industry, DeSoto Hotel, Savannah, Ga., Oct. 18-21, 1937.

[1] Member TAPPI, International Paper Company, Glens Falls, N. Y.
[2] Southern Kraft Corporation, Moss Point, Miss.

Rapid Methods for the Determination of Holocellulose and Cross and Bevan Cellulose in Wood*

By Wm. G. VanBeckum[1] and Geo. J. Ritter[2]

Abstract

Rapid methods are given for the determination of holocellulose and a fraction comparable to Cross and Bevan cellulose. In the procedure for the holocellulose determination ethanol-monoethanolamine is employed, both as a lignin-chloride solvent and as an indicator to show when delignification is complete. The holocellulose obtained is then hydrolyzed to a fraction comparable to Cross and Bevan cellulose by means of an aqueous solution of 1.3 percent sulphuric acid under specified conditions. In addition, the lignin content of the wood is obtained by difference. Thus it is possible to obtain the yields of holocellulose, a fraction comparable to Cross and Bevan cellulose, and lignin on a single wood sample.

Holocellulose is the carbohydrate fraction in extractive-free wood. This report deals with modification of its method of determination and of a method of obtaining a fraction from it that is comparable to Cross and Bevan cellulose. In addition, lignin can be determined by difference.

Holocellulose

Previous Work

In previous work Schmidt *(1)* used chlorine dioxide in an aqueous solution of pyridine to isolate a carbohydrate fraction designated "Skelettsubstanz," which constituted practically the entire carbohydrate fraction in extractive-free wood. The chief objection to the use of this procedure for routine analysis is that approximately one month is required to make the determination.

Later Tang and Wang *(2)* modified Schmidt's procedure by increasing the concentrations of the chlorine dioxide and the pyridine. This modification lessened the time required for the determination but decreased the yield of "Skelettsubstanz."

In 1933 Ritter and Kurth *(3)* improved the procedure by employing an alcoholic solution of pyridine as a solvent for chlorinated lignin. Repeated chlorination and extraction with this solvent reduced the time required for the determination in maple to approximately two days and yielded a more complete carbohydrate residue. The same investigators found it necessary to alter the procedure for the determination of holocellulose in spruce, a softwood *(4)*.

Bird and Ritter *(5)* used white oak as a material on which to continue the study of the determination and the properties of holocellulose. They found that the method employed on maple by Ritter and Kruth *(3)* gave more satisfactory results on oak than that employed on spruce *(4)*.

Experimental Work

The determination of holocellulose in wood consists in the removal of lignin and the retention of the holocellulose. Previous work on the determination had shown that lignin can be removed from wood as lignin chloride. The first step in the experimental work therefore dealt with the finding of a solvent that would rapidly dissolve lignin chloride but would not dissolve isolated holocellulose. Lignin chloride prepared from lignin isolated by the sulphuric acid method *(6)* was found to be fairly soluble in acetone, ethanol, methanol, ethylene glycol, and glycerol in which solvents holocellulose, prepared by the alcohol-pyridine method *(5)*, was practically insoluble.

The addition of monoethanolamine, diethanolamine, or triethanolamine increased the solubility of lignin chloride in the foregoing solvents. These amines produced red solutions with hardwood lignin chloride and brown solutions with softwood lignin chloride. On the other hand, neither the solubility nor the white color of the holocellulose in these solvents was altered by the addition of the amines.

The choice of a lignin-chloride solvent from among those tested for use in the holocellulose determination depended on several factors. Among the factors considered were: (1) the rapidity with which the lignin chloride dissolved; (2) the insolubility of the holocellulose in the solvent; (3) color effect produced by the solvent on the lignin chloride and the holocellulose; and (4) the concentration of the amine in the solvent required to produce the desired solubility. On the basis of the foregoing factors a solution of 95.0 per cent ethyl alcohol containing 3.0 per cent of monoethanolamine was selected as the most promising lignin-chloride solvent. Its suitability as a lignin-chloride solvent was next tested on wood.

The tests were made on wood meal (60-80 mesh) freed of its extraneous materials soluble in alcohol, alcohol-benzol, and hot water. When several alternate applications of chlorine and the lignin-chloride solvent were made on the chlorinated wood, color changes were noted as delignification progressed. Chlorinated hardwoods turned cherry red when treated with ethanol-monoethanolamine solution, whereas chlorinated softwoods treated likewise turned brown. As delignification progressed by repeated alternate treatments the red color that first developed in the hardwoods gradually changed to brown and then to white. Softwoods treated similarly changed also from brown to white. This final color change in both woods was temporarily used as an end point to indicate complete delignification. The

*Presented at the Fall Meeting of the Technical Association of the Pulp and Paper Industry, DeSoto Hotel, Savannah, Ga., Oct. 18-21, 1937.

Report of work supported in part by a research grant from the Technical Association of the Pulp and Paper Industry and carried out with the cooperation of the TAPPI Fibrous Materials Testing Committee.

1. Member TAPPI Student Assistant, Forest Products Laboratory, Madison, Wis.

2. Senior Chemist, Forest Products Laboratory, Madison, Wis.

repeated treatments for removing the lignin introduced additional factors which required consideration. Important among them were (1) the effect of water on the determination, and (2) the effect of the temperature on the color changes resulting from the action of the lignin-chloride solvent.

As in previous studies, water was found necessary to facilitate the chlorination of wood. However, excess moisture inhibited chlorination as is evidenced by the increased number of treatments required for delignification. The moisture required for chlorination and the hydrochloric acid formed during this operation were largely removed with alcohol to minimize acid hydrolysis of the holocellulose. Again, before adding water for the next chlorination, it was necessary to remove the lignin-chloride solvent with alcohol so as to avoid the formation of an aqueous-monoethanolamine solution, which has a solvent action on the holocellulose.

The effect of the temperature on the color change resulting from the action of the lignin-chloride solvent on lignin chloride was noted when the solvent was applied at various temperatures between 15 and 85 deg. C. Although the color changes accompanying the removal of the lignin at the various temperatures were similar, at temperatures below 75 deg. C. the residues obtained after treatment with the lignin-chloride solvent proved to be impure. It was found necessary to use temperatures of at least 75 deg. C. in order to effect the removal of the last traces of lignin.

TABLE I.—APPARENT HOLOCELLULOSE YIELDS OF ASPEN HOLOCELLULOSE OBTAINED BY USING LIGNIN-CHLORIDE SOLVENT AT VARIOUS TEMPERATURES

Temperature of Solvent Deg. C.	Apparent yield of holocellulose based on weight of oven-dry wood Per cent
15	87.9
25	86.4
40	84.4
60	82.9
75	82.5
85 (a)	82.5

(a) Boiling point of solvent elevated by the addition of glycerol.

The variation among apparent holocellulose yields at the different temperatures in Table I was later ascribed to a difference in the sensitivity of the end-point indicator at those temperatures. This was shown to be true because a brown color developed when hot (75 deg. C.) lignin-chloride solvent was added to holocellulose which was prepared below 75 deg. C. This conclusion was further confirmed when the excess material in the holocellulose prepared at 25 deg. C. was isolated and found to be lignin chloride. At 75 and 85 deg C. the color reactions of the indicator were the same and the yields of holocellulose were also the same. It was therefore concluded that 75 deg. C. was the approximate minimum temperature at which the indicator was reliable for detecting small amounts of lignin chloride in the presence of holocellulose.

After finding the effects of water and temperature of the lignin-chloride solvent on the holocellulose determination it was possible to work out the following procedure.

Procedure for the Determination of Holocellulose

Extractive-free wood is used for the holocellulose determination. To prepare it extract 2.5 grams of wood meal (60-80 mesh) for 4 hours in a Soxhlet apparatus with 95 per cent alcohol and then with a constant-boiling mixture of alcohol-benzol. Wash the residue with alcohol to remove the benzol and extract it with 400 cc. of hot water in an Erlenmeyer flask for 3 hours in a boiling-water bath, filter, wash with hot water, and air dry.

Weigh accurately, in a tared alundum crucible, about 2.0 grams of air-dry extractive-free wood whose moisture content is known. Moisten the material with cold distilled water (10 deg.C.) and remove the excess moisture by suction.

Using moderate suction, chlorinate the sample by passing the gas through a funnel inverted over the crucible, which is held in position on a suction flask. After 3 minutes' chlorination remove the inverted funnel, stir the meal thoroughly, and rechlorinate for 2 minutes.

Add alcohol to dissolve excess chlorine and hydrogen chloride and after 1 minute remove by suction. Release the vacuum, add sufficient hot alcohol-monoethanolamine to cover the wood completely, and stir thoroughly. Allow the solution to stand 2 minutes, then remove by suction. Repeat the solvent treatment. Remove any remaining solvent by washing twice with 95 per cent ethanol and twice with cold water. Remove excess moisture by suction. Repeat the chlorination and extraction treatments until the residue becomes white following chlorination and is no longer colored by the addition of the hot lignin-chloride solvent. Remove the alcohol-monoethanolamine by washing twice with alcohol, twice with cold water, and again with alcohol until the residue is neutral to litmus. Finally wash with ether to facilitate drying.

Air dry the holocellulose to remove excess ether and then dry to constant weight in an oven at 103 deg. C. Calculate the percentage of holocellulose on the basis of the extractive-free wood.

Testing of Method

The ability to reproduce results by the method was tested by comparing the results of several separate determinations on balsam fir as is shown in Table II.

TABLE II.—RESULTS INDICATING REPRODUCIBILITY OF THE HOLOCELLULOSE DETERMINATION ON EXTRACTIVE-FREE BALSAM FIR

Sample No.	Yield of holocellulose based on oven-dry weight of wood Per cent
1	69.8
2	70.2
3	69.6
4	69.3
5	70.1
6	70.0
7	69.7
8	70.6
Average	69.9

II. Eight such determinations show a maximum variation of 1.3 per cent and a maximum deviation of 0.7 per cent from the average.

The accuracy of the holocellulose method was tested by comparing the weight of the extractive-free wood (taken as 100 per cent) with the sum of the yields of holocellulose and lignin as determined by the sulphuric acid method in nine woods as shown in Table III, column 4. The accuracy of the lignin determination obtained by difference is in remarkable agreement with that obtained by the sulphuric acid method *(6)*. The comparison of corresponding lignin yields (Table III. columns 2 and 3) shows a maximum variation of 0.5 per cent.

Residue Comparable to Cross and Bevan Cellulose

Holocellulose is composed of Cross and Bevan cellulose and the hemicellulose fraction that dissolves

TABLE III.—RESULTS INDICATING THE ACCURACY OF THE HOLOCELLULOSE DETERMINATION

(Based on oven-dry [103 deg. C.] weight of the extractive-free wood.)

Wood	Holocellulose by new method (1) Per cent	Lignin by difference (Extractive-free wood minus holocellulose) (2) Per cent	Lignin by sulphuric acid method (6) (3) Per cent	Lignin and holocellulose (Col. 1 + Col. 3) (4) Per cent
White spruce	73.3	26.7	26.6	99.9
Red spruce	72.9	27.1	26.6	99.5
Jack pine	72.5	27.5	27.2	99.7
Balsam fir	69.9	30.1	30.1	100.0
Eastern hemlock	68.5	31.5	31.5	100.0
Aspen	82.5	17.5	17.3	99.8
White oak	75.4	24.6	24.1	99.5
Maple	76.3	23.7	23.5	99.8
Willow	78.3	21.7	22.0	100.3

with the lignin during the isolation of the Cross and Bevan cellulose. It should then be possible to convert holocellulose to a residue comparable to Cross and Bevan cellulose by a solvent that will remove the hemicellulose fraction under consideration.

In previous work Kurth and Ritter *(4)* obtained a carbohydrate residue comparable to Cross and Bevan cellulose when they hydrolyzed spruce holocellulose for 30 minutes with boiling 1.0 per cent sulphuric acid. They made no attempt to revise the procedure so that it would be applicable to the holocellulose of other species because their study was confined to spruce.

The procedure by Kurth and Ritter *(4)* was revised after determining the effects produced by changes in the temperature and concentration of the acid and in the time of the hydrolysis. The temperature of hydrolysis was finally fixed by the use of a boiling water bath and the time of hydrolysis was changed from 30 to 120 minutes. Having fixed these two variables, work was centered on finding the proper acid concentration for removing 18.4 per cent of hemicellulose from aspen holocellulose and 12.1 per cent hemicellulose from white spruce holocellulose of the woods worked on because these values represent the difference between the holocellulose and the Cross and Bevan cellulose in the two woods, respectively. Points "a" in the curves indicate that these percentages of the holocelluloses are removed by an aqueous 1.3 per cent sulphuric acid solution when the hydrolysis is conducted 2 hours in a boiling water bath. The data in Fig. 1 were then used as a basis for the following procedure for the determination of a fraction comparable to Cross and Bevan cellulose.

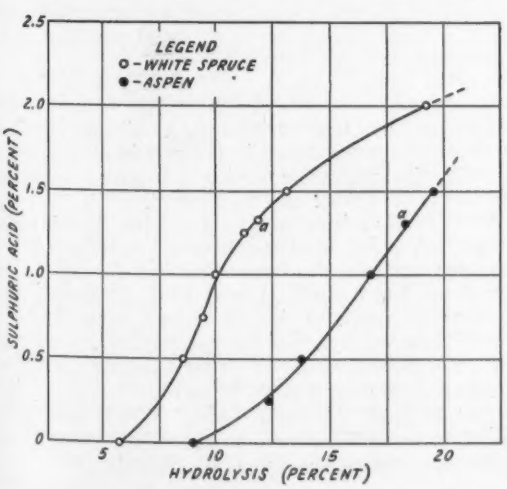


FIG. 1.

Acid Hydrolysis of Holocellulose for 2 Hours at Temperature of Boiling Water Bath.

PROCEDURE FOR THE DETERMINATION OF A FRACTION COMPARABLE TO CROSS AND BEVAN CELLULOSE BY THE UTILIZATION OF HOLOCELLULOSE

Place the crucible and contents from the holocellulose determination in a 600-cc. beaker and add 200-cc. of boiling 1.3 per cent sulphuric acid. Place the beaker and contents in a boiling water bath whose level coincides with that of the solution in the beaker. Continue the hydrolysis for 2 hours, maintaining the original levels of the acid solution and the water bath by the addition of water.

Filter the solution through the crucible and wash the hydrolyzed holocellulose with 150 cc. of hot water. After transferring the residue to a clean tared crucible, wash with hot water until neutral to litmus, then with 20-cc. of alcohol, and finally with 20-cc. of ether. Air dry the hydrolyzed material to remove excess ether and dry to constant weight in an oven at 103 deg. C. Calculate the percentage of Cross and Bevan cellulose on the basis of the oven-dry extractive-free wood.

TESTING OF METHOD

The ability to reproduce results by the method was tested by comparing the results of duplicate determinations on several woods, as is shown in Table IV. These values show a maximum variation for any one wood of 0.7 per cent.

The accuracy of the method was tested against a reliable Cross and Bevan method (*7*). The results (the average of two or more determinations) of the tests are shown in Table V. They show a maximum variation of 1.1 per cent between the corresponding yields of Cross and Bevan cellulose in balsam fir, and an average variation of 0.43 per cent for the nine woods.

Summary

1. A new and rapid method is recommended for the determination of a holocellulose in wood. It employs a solution of monoethanolamine in ethyl alcohol as a lignin-chloride solvent and as an indi-

TABLE IV.—RESULTS INDICATING REPRODUCIBILITY BY METHOD FOR HYDROLYING HOLOCELLULOSE TO A FRACTION COMPARABLE TO CROSS AND BEVAN CELLULOSE

Holocellulose	Yield of fraction comparable to Cross and Bevan cellulose based on oven-dry weight of extractive-free wood Per cent
White spruce	61.2
	60.8
Aspen	63.3
	64.0
Eastern hemlock	55.2
	55.6

TABLE V.—RESULTS INDICATING THE ACCURACY OF THE METHOD FOR HYDROLYZING HOLOCELLULOSE TO A FRACTION COMPARABLE TO CROSS AND BEVAN CELLULOSE

(Results based on oven-dry [103 deg. C.] weight of extractive-free wood)

Wood	Cross and Bevan cellulose: By hydrolysis of holocellulose Per cent	Cross and Bevan cellulose: By Cross and Bevan method applied to wood (7) Per cent
White spruce	61.0	61.2
Red spruce	60.5	60.3
Jack pine	59.1	58.3
Balsam fir	55.3	56.4
Eastern hemlock	55.4	56.0
Aspen	63.7	64.1
White oak	60.2	59.6
Maple	57.9	57.9
Willow	61.5	61.8

cator for complete delignification. The method has been tested for accuracy on nine different woods.

2. A method is offered for utilizing holocellulose for the determination of a fraction comparable to Cross and Bevan cellulose. It has been tested for accuracy against a reliable Cross and Bevan method.

3. The lignin content of nine woods has been obtained by difference; that is, extractive-free wood minus holocellulose is equivalent to lignin. The accuracy of this method is in close agreement with that of the sulphuric acid method.

4. By employing the foregoing methods, the holocellulose, a fraction comparable to Cross and Bevan cellulose, and the lignin content of extractive-free wood can be determined on a single wood sample.

Acknowledgments

The authors wish to express their appreciation to the Technical Association of the Pulp and Paper Industry for the provision of a graduate fellowship and to the Fibrous Materials Testing Committee of TAPPI for cooperation in the research. They are also grateful to R. L. Mitchell, Forest Products Laboratory, for valuable suggestions.

Literature Cited

(1) Schmidt, E., Tang, Y. C., and Jandebeur, W. *Cellulosechemie* 12:201 (1931).
(2) Tang, Y. C. and Wang, H. L. *Cellulosechemie* 16:57-64 (1935).
(3) Ritter, Geo. J. and Kurth, E. F. *Ind. Eng. Chem.* 25:1250 (1933).
(4) Kurth, E. F. and Ritter, Geo. J., *J. Amer. Chem. Soc.* 56:2720 (1934).
(5) Bird, C. D. and Ritter G. J., *J. Amer. Chem. Soc.* 59:802-3 (1937).
(6) Ritter, G. J. and Barbour, J. H. *Ind. Eng. Chem.* (anal. ed.) 7(4):238 (1935).
(7) Ritter, G. J. *Ind. Eng. Chem.* 16:947 (1924).

Cost of Pulpwood at Southern Mills—Cost of Growing Pulpwood*

By William L. Hall[1]

Abstract

The aim of this paper is to report as accurately as possible the costs of processing and delivering pine pulpwood at southern mills during 1937, including stumpage. Since costs have substantially increased during the year the intention is to reflect as closely as may be the condition at midyear. Considerable variation exists between costs at different operations, especially between those of the eastern and western division of the pine belt. Effort has been made, we hope without too great error, to represent average conditions. A second part of the paper deals with the cost of growing pine pulpwood in the South. Inasmuch as the 160 cubic foot unit is in more common use than any other unit of measurement costs are given on the basis of that unit.

Processing Costs

CUTTING AND PENNING:

The length of a stick is generally 5 feet, but most operations west of the Mississippi River, and some of those east of the Mississippi, use 4½ foot wood. Sticks above 12 inches in diameter may be split into halves, those above 15 inches are usually quartered. Not much wood above 16 inches is used. Costs of cutting in 1937 have ranged from 75 cents to $1.25 per unit. The most common rate at the middle of the year, especially in the east, appears to be $1.25. Practice as to penning is variable. Where used the pen is the unit of measurement and basis of payment. Five pens 6 feet high are considered a unit. Price has varied from 15 to 25c per pen, the latter rate being more common. Penning appears not to have increased cost.

PEELING:

Peeling is not generally practiced but is required in certain operations. It is done in the woods with a special hand tool. The cost is about 75c per unit. In some cases bark is left on until loosened by bark beetles and drying.

Delivery

Wood is delivered to southern mills by truck, by rail and by water. Truck delivery is the most common method for distances within 30 miles of plant. Trucks carrying 1, 1½ and 2 units are in common use. A Georgia operation, a Mississippi operation and an Arkansas operation give figures which indicate $2.25 per unit as about the average price of truck haul. The present average truck haul is about 20 miles. For distances within five miles trucking costs may be as low as $1.35 while for distance of 20 to 30 miles they may be $3.00 or more. All wood is delivered under some sort of contract. In truck delivery the system is more simple than by rail or water delivery, but even in truck delivery there is usually a contracting cost ranging from 25 to 50c per unit, with a considerable part of the contracting cost going for upkeep of trucks and other equipment. Considering cutting, trucking to mill and contracting, the cost of delivered wood, excluding stumpage, may be said to run from $3.25 to $5.00 per unit, with an average not far from $4.00.

Stumpage

This is the most variable item of the schedule. Most stumpage purchases in the past have been made in bulk, the contractor paying an agreed price for the block of timber and cutting all of it he could take. This has been a favorable plan for the contractor. A good share of whatever profit he has had has been made in this way. He has frequently obtained wood at a cost as low as 15 to 20 cents a unit. This profit, however, is not passed on to the mill whose standard practice has been to set up an f.o.b mill price, which under different trucking conditions during the present year will allow stumpage prices of 75c to $1.00 per unit. With a $5.00 mill price, which is believed to be not far from average, the following break-down would be typical:

Cutting	$1.25
Hauling	2.25
Contractor	.50
Stumpage	1.00
Total	$5.00

* Presented at the Fall Meeting of the Technical Association of the Pulp and Paper Industry, DeSoto Hotel, Savannah, Ga., Oct. 18-21, 1937.

[1] Consulting forester, Hot Springs, Ark.

With a haul of under 10 miles the trucking cost might go down to $1.75 and the stumpage up to $1.50, or the contractor's returns might increase. It appears to be true that truck wood is the cheapest wood the southern mills obtain. The cost of such wood in 1937 appears to have varied from $3.75 to $6.25 per unit of 160 cu. ft. of rough wood. As stated at first, there has been a marked increase in cost during the year.

Rail Delivery

Turning now to delivery by railroad, we find three of the four cost factors considerably changed. The cost of cutting is slightly lowered. Maximum truck haul is reduced from 30 miles to about 10 miles, with average cost cut from $2.25 to about $1.75, based on an average haul of 5 miles. Freight haul varies from 35 miles or less to about 250 miles with an average of probably about 100 miles. Freight costs also vary from operation to operation in a marked degree. There is, without doubt, a variation of as much as $1.25 per unit between operations enjoying the lowest freight costs and those sustaining the highest costs. This variation extends from a minimum average of $1.25 per unit to $2.50 per unit. The average freight cost for southern mills, based on an average haul of 100 miles, appears to be in the neighborhood of $2.00 per 160 cu. ft. unit. Very often there is a rehandling charge or "switching" charge, which will add as much as 25c to average cost per unit. Average f.o.b. mill cost of rail wood for the south appears to be about as follows:

Cutting and penning	$1.15
Hauling to railroad and loading	1.75
Freight	2.00
Rehandling or switching	.25
Contractor	.50
Stumpage	.60
	$6.25

The 50c item to contractor is commonly split between a general contractor and a subcontractor. The stumpage item may increase or decrease, depending upon the amounts going for truck haul and for freight. The nearer to railroad and nearer to mill the better the timber owners' opportunity to realize on his stumpage. But stumpage for wood shipped by rail costs generally not over 75c per unit. We use 60c as an average figure.

Barge Delivery

Not all southern mills are so situated as to take advantage of water transportation. Those that are so situated enjoy a considerable advantage in costs besides having an additional dependable system for supplying their plants. Contrasting with an average freight cost of about $2.00 per unit, it appears that the average barging cost is not over $1.25 per unit for a distance of 100 miles. Barge wood must always be banked at the landing and this involves an extra cost of about 50c a unit. With items other than transportation remaining the same as for railroad wood, the average cost of barge wood in 1937 may be considered as about $5.75 per unit f.o.b. mill dock. Tow boats and barges are usually owned by the companies themselves or their larger contractors. It appears reasonable to assume that the cost of barging wood may decrease as experience grows and equipment is improved.

Summarizing wood costs at mill for the three systems of delivery at midyear 1937, we find: Truck wood with a range from $3.75 to $6.25 per unit of 160 cu. ft. and an average somewhere near $5.00. Railroad wood with an average of near $6.25. Barge wood with an average of about $5.75.

Trend of Costs During Past Decade

It helps to a clear understanding of the southern pulpwood situation to consider costs today in comparison with those of ten years ago. Not many pulp mills were operating in the south ten years ago. Those that were operating were generally paying about $6.00 per standard cord of 4 ft. wood laid down at the mill. It is probably fair to assume an average of $5.75 per unit of 5 ft. wood in 1937. Reducing these costs to a common standard cord of 128 cu. ft., the cost of $6.00 in 1927, compares with a cost of $4.60 in 1937, a reduction of some 23 per cent. What factors have played into this impressive reduction? Not labor or freight. These remain about unchanged. Here are the factors to which we think credit is due:

Improved roads
Improved trucks and other equipment
Improved organization and methods
Increased skill in labor
Increased percentage of truck and water shipments
Lower handling costs by lengthening the stick
Lower stumpage through lengthening the stick from 4 ft. to 4½ or 5 ft.

Note these items again and consider that except the last one, all probably represent permanent gains. The first five factors listed may be expected to bring even further gains. Roads will be further improved as will equipment. Labor will further increase in skill. We may look forward to further increase in percentage of truck and barge wood. These factors should operate in the direction of holding pulpwood prices steady, or possibly even lowering them.

Future Trend of Costs

There are, on the other hand, factors which almost certainly will tend to increase the cost of pulpwood. These are higher taxation, higher labor and higher stumpage.

Taxes constantly go higher and this will affect costs of producing pulpwood as it affects industrial operations of all kinds. Increased taxes on truck operation bear heavily on pulpwood production.

Far the greater part of southern pulpwood is produced by farm labor, partly white labor, but mostly colored. It is labor which has never been accustomed to high wages; its housing costs are very low; its food supply largely comes from the farm. Some of this labor is actively engaged in crop production part of the year and works in pulpwood only between crop activities, or some members of the family may work in pulpwood while other members grow the crops. It takes on pulpwood work as a means of increasing cash income, not fundamentally to subsist. It can subsist without it. This labor at the start is unskilled, but it tends to become skilled as it gains experience and is subjected to supervision. Pulpwood labor may properly be looked upon as an adjunct to farm labor, and the pulpwood business betters the farm outlook. It helps young farm boys in their upper teens get jobs. It enables them to marry early and establish simple homes. As children grow up schools are available for their education. This is true for colored as well as for white. Under these stable conditions, labor is at present contented. It will remain contented if outside subversive influences do not overwhelm it with suspicion, selfish interest

and unrest. As southern pulpwood labor becomes more efficient, its pay increases and this year is seeing increases in unit pay, corresponding to general increases in cost of living as they affect this class of labor. The growing pulp industry of the south will increase competition for this class of labor. Competition will increase the wage scale. But it is not evident now that increased labor costs will largely influence the cost of pulpwood in the near future.

Recent stumpage advantage to the operator has rested on the fact that during the past five years a 144 cu. ft. unit or a 160 cu. ft. unit has been bought at about the price of a 128 cu. ft. cord prior to 1930. This advantage is now crumbling and it will not long continue. The modification which is under way is mainly the result of competitive buying and as yet is evident only in certain districts. Competition will without doubt be the largest factor in determining stumpage values and who can tell what the competition may be, even five years from now. Pulpwood buyers compete, not only among themselves, but with other industries for small merchantable pine. Sawmills, cooperage plants, tie makers, pole cutters, naval stores operators all feed on second growth southern pine. Free play of competition between these industries and between the pulp mills now operating or building will be sufficient to raise the price of pine stumpage to the point where the growing of crops of pine timber will be increasingly attractive in many districts.

Cost of Growing Pulpwood in the South

The cost of growing pine timber, which is the second part of this paper, will now briefly be considered. Cost of land in the south suitable for growing pine pulpwood or other pine products has not changed much in the past ten years. In 1927, land carrying 3 or 4 cords of pulpwood per acre, except in the main naval stores region, could be bought for $4.00 to $5.00 per acre. In 1937 the same class of land can be bought for the same price. If bare land is acceptable it may be had at $1.50 to $2.00 per acre. But the cost of planting to obtain a growing stock of trees will bring the cost of this land up to $6.00 or $7.00 per acre. The cheapest land is that which can be acquired with a stand of trees already present. As an example, let us assume an acre of land carrying a stand of 4 units of 160 cu. ft. per acre and having a value of $5.00. Approximate costs of carrying this land each year are assumed to be:

Taxes at .10 per acre	.10
Protection and supervision	.10
Interest at 5 per cent	.25
Yearly cost	.45

Under protection and management as here provided the acre may be expected to produce by growth about one-half a 160 cu. ft. unit per year. At a valuation of $1.00 per unit the return will exceed the cost by .05. From pulpwood considerations alone it would appear that until wood reaches a value of more than $1.00 per 160 ft. unit there is slight chance for anything more than meeting the carrying charges with interest on a low valuation. In situations where more than $1.00 per unit can be obtained for wood, or more than one-half unit per acre can be produced there appears prospect of a small profit. Such situations are not rare; they prevail over considerable areas and are found in districts which combine high productivity with low transportation costs. They increase as stumpage prices increase and as better methods of forest culture are employed.

Again, the opportunity varies with ownership. No other class of owners can produce wood as cheaply as can the farmer. Until the pulp mills came his small timber had no value. It gave no returns. If now it will yield even 3 per cent on a $5.00 land valuation which it will do at 75c a unit, that is a gain, a distinct gain, for him. If he is so situated as to command a price of $1.00 or more per unit, as many already are, his opportunity expands accordingly. Under stimulus of competition stumpage prices are gradually increasing. With the farm stumpage owner standing today on the threshold of a profit from timber growing, further increases in stumpage price will awaken new interest in his timberlands and in forest culture. Should stumpage values continue their upward trend until the landowner receives 40 or 50 cents per unit more than he receives today, the whole wood situation and the farm situation of the south would vastly change. Many thousands of acres of neglected farm woodlands would be taken in hand and started on the road to steady production.

Although the corporate timber owner cannot grow timber as cheaply as can the farm timber owner, the pulp and paper mills of the south are generally committed to the policy of timberland ownership on a scale sufficient to guarantee a considerable percentage of their wood requirements from their own lands. Daring indeed would be the operator who at the present would risk millions of dollars in a pulp and paper installation without providing a back log of owned timberland sufficient to insure a good portion of his permanent wood supply. Lands acquired for this purpose must of course be kept productive. This means their productivity must be built up, for few tracts of as much as 50,000 acres are today even 50 per cent productive. Forestry must come on the corporation-owned pulpwood lands of the south. There is no alternative. As pulp and paper corporations begin to supply wood to their plants from their own lands they realize the necessity of crediting that wood with a value high enough to cover cost of production. That figure, though it may vary from one operation to another, will in general be above present values for outside wood. This ownership of timberlands, and the production of wood therefrom, necessary as it is, will prove a definite factor in increasing the general market value of pulpwood.

Southern pulp and paper corporations, desiring to fortify themselves for long-time production may well direct their efforts along two lines as to wood supply. First, ownership of timberlands extensive enough to supply by current growth at least half their estimated wood requirements. This for insurance and also, if necessity arises for depending more largely upon this source of supply a foundation will have been laid in advance. Second, whole-hearted effort to encourage and promote the growing of pulpwood by private landowners within trucking distance of the plant and within easy railroad or water haul. Highly important objectives may be reached through this course. It will increase the prosperity of the adjacent territory; it will build up community interest and pride in the pulp and paper mill,; it will, as the years pass, give the mill its cheapest wood, for the simple reason that it will be produced more cheaply than any other class of wood.

Of course, pulpwood is not the only thing the southern timberland owner is going to produce. For naval stores pines it will be possible to take large returns from gum products before the trees are cut. In stands of other timber, sawlogs and other products will be sought as yielding higher returns. Those are merely problems of production which will be worked out. From all pine stands pulpwood in quantity can be produced. Pulpwood is the element that rounds out the opportunity for the southern timberland owner. A large and steady pulpwood supply is the need of the southern pulp and paper industry. It can be obtained in great volume by pulp producers and landowners working together.

History of Pulp and Paper in the South*

By J. H. Allen[1]

Bagasse is Unsuccessful—1898

It was in 1898 that an English syndicate built a paper mill at Braithwaite, La., with the idea of making paper from bagasse. The experiment failed. This mill was leased in 1915 by the E-Z Opener Company and was successfully operated under Messrs. Westervelt and Hartman until 1931, when most of the equipment was moved to Tuscaloosa where the Gulf States Paper Corporation now have their plant with a capacity of 200 tons per day.

Sulphate is Made at Orange—1911

The first real attempt to make paper from southern pine was undertaken by Smith and Thomas at Pensacola, Fla., about 1903. Their efforts were not entirely successful and finally the Letcher Moore Lumber Company bought all of the equipment and moved it to Orange, Tex. For several years this mill passed through various stages of experimental work and in 1911 the process was changed by Edward H. Mayo from soda to sulphate. This was the turning point toward the consummation of a successful commercial product. Edward H. Mayo can accordingly claim the honor and distinction of being the first man to make sulphate pulp out of yellow pine trees in the South.

Financiers Skeptical—Moss Point is Financed Abroad—1913

The second mill to use southern pine was built at Moss Point, Miss., in 1913. At this time there was still considerable skepticism regarding the use of southern pine as a raw material and it was found necessary to finance the Moss Point development largely in England. Before the mill was put up southern wood was sent to Billingfors, Sweden, where it was made into sulphate pulp, both bleached and unbleached, and the pulp ultimately taken to England to be converted into wrapping paper and white book. This demonstration convinced the British investors, and the Southern Paper Company was founded thereafter.

Butcher Fiber Made at Roanoke Rapids, 1907

In 1906, a mill was built at Roanoke Rapids and the first paper known as "butcher fiber" turned out in June, 1907. The plant had a daily capacity of 30 tons. This plant is owned by the Halifax Paper Company, Inc., and is being enlarged at the present time.

Fourdrinier Board Made at Hopewell, 1923

Letcher Brown, executive of the Letcher Moore Company, decided to carry on in the paper industry and the Brown Paper Mill Company at Monroe, La., of which he is president and controlling stockholder, is therefore a large offspring of the plant at Orange, Tex. The first unit, started in 1923, went into operation in 1924 with a capacity of about 80 tons and has now been expanded to a capacity of 600 tons daily. In 1927, this company started the manufacture of Fourdrinier board. This type of board was first made, however, by Hummel Ross Fibre Corporation at Hopewell, Va., in 1923.

Bogalusa Converts Refuse Into Pulp

Somewhere around the year 1915, Col. A. C. Goodyear, a man of great vision, with a sawmill operation at Bogalusa, making some twenty million feet of lumber monthly, decided to put out his refuse burner and convert the refuse into pulp and board. Today his development, the Bogalusa Paper Company, is turning out pulp, paper and board at the rate of 250 tons per day.

In 1917, the Chesapeake Corporation at West Point, Va., installed a cylinder jute manufacturing mill. In 1930 a Fourdrinier machine was installed that is producing today an average of 300 tons of kraft liner daily under the successful handling of Messrs. Ellerson and Olsson.

International Begins Development in the South

R. J. Cullen, backed by L. H. Fox of Kansas City, in 1920 built a sulphate pulp mill at Bastrop, La., for a capacity of 75 tons per day. He then added a paper machine and promoted and built the Louisiana Pulp and Paper Company, which is producing today better than 225 tons. The Bastrop mill was sold to the International Paper Company, and in 1926 the Louisiana Pulp and Paper Company was also purchased by that company. Mr. Cullen joined the ranks of the International to form the Southern International Pulp and Paper Company, of which he was made president. In 1928 Southern International Pulp and Paper Company finished their mill at Camden, Ark. A year later they built a plant at Mobile, Ala., which is producing today close to 200 tons of pulp and paper. At this time, Southern Kraft Corporation was formed and Southern International dissolved. In 1931 the former completed their Panama City mill, which now has a daily capacity of 600 tons. Their Georgetown mill of recent construction, it is understood, turns out 600 tons of board and dry pulp per day. Construction of another mill at Springhill, La., has also begun.

Champion Pioneers High Grade Papers From Pine

The Southern Advance Bag and Paper Company, Inc., was built under the direction of Mr. John Kelly

* Presented at the fall meeting of the Technical Association of the Pulp and Paper Industry, DeSoto Hotel, Savannah, Ga., Oct. 19, 1937.

[1] Vice-President Union Bag and Paper Corporation.

at Hodge, La. Their first machine was installed in 1928 and the second in 1931, giving a capacity of 200 tons per day.

The Champion Fibre Company at Canton, N. C., has played a very important part in the development of the industry in the South through the management of Mr. Robinson, its president, and his belief in constructive research. For many years they have been making book, bond, bleached sulphate, newsprint, and other high-grade papers out of southern yellow pine. Within the current year, the Champion Fibre has erected a bleached sulphate plant at Houston, Tex.

Union Bag Builds First Post-Depression Mill—1936

In the summer of 1936, the first of the post-depression mills to be built, that of the Union Bag and Paper Corporation, with Alexander Calder president and J. H. Allen executive vice-president, started operation of its initial pulp and paper mill development in the South at Savannah, Ga. By the end of 1937 this mill will have a productive capacity of 650 tons of paper and board, and 100 tons of surplus pulp per day.

New Mills Completed or Under Construction—1937

The West Virginia Pulp and Paper Company under the direction of the Luke family has also realized the opportunities in the South, and this year finished a 300-ton board mill at Charleston, S. C. The Federal Government through the R. F. C. financed in 1936 the 140-ton pulp mill for the Crossett Lumber Company in Arkansas. The jute industry has also become interested in the South—the Kieckhefer Container Company with the Robert Gair Company now have a mill under way at Plymouth, N. C., and the Container Corporation of America at Fernandina, Fla. The Mead Corporation with Edward Ball of Jacksonville, are building a 300-ton board mill at St. Joe, Fla., and the Camp Manufacturing Company with Messrs. Ellerson and Olsson are constructing a 150-ton board mill at Franklin, Va. The Mead Corporation and Scott Tissue have commenced this year construction of a bleached sulphate pulp mill at Brunswick, Ga.

They Have Built Mills in the South to Supply 20 per cent of the Nation's Demand

Messrs. Mayo, Westervelt, Brown, Hardy, Wallace, Goodyear, Hummel, Cullen, Cullerson, Kelly and others have been the rugged individuals who in twenty-five years have built plants south—plants which will have in 1938 a combined capacity of one million seven hundred thousand tons of sulphate pulp. This means that 20 per cent of the entire consumer demand in the nation will have been transferred from foreign countries to the South.

Review Of The Paper Industry Literature

Abstracts Compiled By the Abstracts and Bibliography Committee of the Technical Association of the Pulp and Paper Industry, A. Papineau-Couture, John F. Ohlson, C. E. Peterson and Clarence J. West, Chairman.

Copies of United States Patents can be obtained from the United States Patent Office, Washington, D. C., for 10 cents each. Send currency, not stamps.

Cellulose

The Action of Schweizer's Reagent and Ammonia on Wood and Other Vegetable Substances. A Study of Cuproxam Lignins. R. S. Hilpert and Quan Sut Woo. Ber. 70B, No. 3: 413-421 (March 3, 1937).—When spruce wood is treated with Schweizer's reagent, approximately 80 per cent dissolves a residue with 8 per cent methoxyl. On treatment of this residue with 72 per cent sulfuric acid, lignin is obtained in a yield of 46.8 per cent, with a methoxyl content of 15.1 per cent and a nitrogen content of 1.7 per cent. Part of the dissolved material can be precipitated by fractionated precipitation from the cuprammonium solution. These precipitates contain 2.1-2.6 per cent methoxyl and have a higher carbon content that that calculated for cellulose. In a similar way white beech, rye straw, sisal hemp, jute, and peelings of asparagus are extracted by means of Schweizer's reagent. From beech only about 35 per cent goes into solution, while in the case of the other materials all but 1-5 per cent is dissolved. The residues show a higher carbon and a higher methoxyl content and also contain 1-22 per cent nitrogen. The analysis of the materials regenerated from Schweizer's solution shows that their composition lies between that of cellulose and that of the original material. On treatment of spruce wood with ammonia, 0.9 per cent nitrogen is taken up. The author finally discusses the effect of nitrogen in the formation of coal.—C. J. W.

New Method for Determining Cellulose in Wood Materials. N. S. Kozlov, L. E. Olifson, and S. M. Gol-dina, Bumazhnaya Prom. 15, No. 10: 16-20 (Oct., 1936); C. A. 31:2411.—The method of Engel and Wedekind for disintegration of fibrous vegetable material with dioxan was developed into a method of determining cellulose. Tests with pine, spruce, birch and alder wood flour gave results accurate to 0.5-0.7 per cent and cellulose practically unchanged and free from pentosans and lignin. The method is: Reflux a 1 g. sample with 15 cc. dioxane containing 2-3 drops of concentrated hydrochloric acid in a water bath for 6 hours. Filter the cellulose in a weighed Schott filter, wash it with water, dry at 100-105 deg. C. and weigh. To determine lignin in the filtrate, reduce the volume to one-third by distilling off the dioxane, precipitate the lignin with water, filter through a Schott filter, dry first in a vacuum desiccator and then at 100-105 deg. C. and weigh. The sugars in the filtrate from the lignin may be determined by Bertrand's method.—C.J.W.

From the Atom to the Visible Fiber. Karl Freudenberg. Papier-Fabr. 35, No. 7: 49-52 (Fed. 12, 1937).—An interesting article concerning the morphology of the fiber and the structure of the cellulose molecule.—J.F.O.

Instrumentation Studies. XX

A Study of Photoelectric Instruments for the Measurement of Color: Reflectance and Transmittance

Part I. A General Discussion of Color and Color Measurements

By The Staff of The Institute of Paper Chemistry

INTRODUCTION

During the past several years many photoelectric instruments have been developed for the objective measurement of color. A few of these instruments are true spectrophotometers and serve admirably for the purposes for which they were designed, namely, general spectral analysis of colored opaque and transparent bodies. Some of the color instruments of the non-monochromatic type have limited but valuable fields of application in pulp and paper manufacture. There are a few "color analyzers", "color comparators", call them what you will, for which extravagant claims are made by the manufacturers or sales agencies; a number of these devices are wholly worthless, and, indeed, their use in pulp and paper mills might lead to two undesirable results: costly losses to the mills, and an unwarranted setback to really worth-while technological applications to industry.

It is the purpose of the present study critically to investigate the existing photoelectric instruments in the laboratory, and to delimit, where possible, their fields of valid application in the pulp and paper industry.

Structure of the Report

The structure of the reports on this study is the following: Part I is of a general but critical nature in which particular instruments are not discussed, but in which the physics of color and color measurement is presented; it is divided into seven sections, as follows: Section I, Physical Aspects and Measurement of Color; Section II, Use of Color Analysis in the Manufacture of Pulp and Paper; Section III, Methods for Physical Measurement of Color; Section IV, Critical Discussion of Spectral, Geometrical, and Photometrical Features of Methods for the Measurement of Spectral Reflectance; Section V, Critical Discussion of Spectral, Geometrical, and Photometrical Features of Methods for the Measurement of Spectral Transmittance; Section VI, I. C. I. System of Color Specification; Section VII, Three-filter Colorimeters. Part II, Part III, etc., will be devoted to specific instruments. Copious references will be made in the reports on individual instruments to discussions in Part I, hence no report should be studied without having Part I at hand. This structure of the reports will eliminate much needless repetition.

A further advantage in making Part I both instructive and critically general is found in the consideration that Part I should aid the technical man in making critical appraisals of color instruments which have not yet been made the subject of instrumentation studies.

SECTION I

Physical Aspects and Measurement of Color

More than two hundred years ago Sir Isaac Newton discovered that sun light could be separated into a blend of pure colors by passing the light through an optical system embodying a glass prism. He also found that light of any of the colors, say green light, could be passed through a second prism without experiencing further splitting into other colors. Yet, if the light reflected from a very green sheet is passed through a similar optical system, it is invariably found that reflected light is composed of all the colors of the visible "spectrum"; this is generally true of all opaque colored bodies: whereas the color of a body may appear as pure as that of one of the spectral hues discovered by Newton, the body actually reflects all of the components of the visible spectrum.

White light is composed of a spectrum of radiations which presents to the normal eye a blending continuum of pure colors. Many years ago it was established that these visible radiations are a small part of a large family of electromagnetic waves. All members of this family travel through empty space at a common speed of 299,796,000 meters per second. The only difference between the members is a difference in wave length (or frequency); in the enormous spread of wave lengths from 0.001 millimicrons[1] (short gamma rays) to thousands of meters (radio waves), visible light extends over the extremely small range, from a little less than 400 to slightly more than 700 millimicrons.

When Newton split up sun light by means of a prism, he was separating the light according to wave length. When various narrow wave length ranges are isolated by means of a prism (spectroscope) and are viewed with a normal, rested eye, various pure colors are seen. Fundamentally, the differences between these several pure colors are attributable only to differences in wave length; and light occurring in any given small wave length range always appears in the same color to a normal eye. If the wave length range is very small, of the order of 1 or 2 millimicrons or less, the light is commonly referred to as "monochromatic". The wave lengths of monochromatic light associated with the principal hues are: violet, slightly less than 400 to 421; blue-violet, 439; blue, 473; blue-green, 498; green, 515; yellow-green, 568; yellow, 577; orange-yellow, 592; orange, 600; red-orange, 631; and red, 644 to slightly more than 700 millimicrons. These values are necessarily approximate, since the hues of the spectrum change gradually from wave length to wave

[1] One millimicron = 0.000001 millimeter.

length, and blend; moreover, two observers will not quite agree on the wave length which best represents a hue like "blue". The wave lengths associated with the principle hues are given here mainly for the purpose of orienting the reader.

It has been stated above that all colored opaque bodies appreciably reflect light of all wave lengths. A perfectly white or gray body reflects light of all wave lengths to the same degree, but colored bodies are colored because they preferentially reflect light in one or more wave length regions, or, in better words, a colored body has reflecting power which varies with wave length. Hence, when a colored body is illuminated with white light, the light reflected to the eye is most intense for a certain wave length, least intense for another, and all intervening intensities exist for the other wave lengths of the visible spectrum. It is well established that color sensation depends uniquely on how the energy of light entering the eye is distributed among the wave lengths from 400 to 700 millimicrons. The distribution of energy among the wave lengths is usually referred to as "spectral energy distribution" (hereafter in this report, the adjective "spectral" will be taken as an abbreviation of the phrase, "variation with wave length of—"). The spectral energy distributions of north sky light, mean noon sun light, "artificial light" from an ordinary electric lamp, and of light from the recently developed sodium vapor lamp used for highway lighting are shown, respectively, in Figs. 1, 2, 3, and 4.

The reader will see at once from the curves of Figs. 1 and 4 why, from a physical viewpoint, the north sky appears blue, and the light from a sodium vapor lamp (monochromatic) appears orange-yellow. It will also be clear that the color of an object should depend greatly upon the spectral energy distribution of the illuminant, as well as upon the reflecting characteristics of the object itself.

In specifying a spectral energy distribution, it is necessary first to adopt a wave length range. A statement giving the number of people in the world having various heights must specify a range of heights, as, for example, ¼ inch. It is necessary to give a number for a definite range, and, in the case of a function like spectral energy distribution, a very small range should be chosen. For definiteness, we may take a range of 2 millimicrons. The ordinate of a spectral energy distribution curve at a wave length of 500 millimicrons then gives the energy of all light passing unit area per second having wave lengths between 499 and 501 millimicrons. To calculate the spectral energy distribution of light reflected to the eye by a colored object, we should then proceed in the following way: At each of numerous wave lengths, we multiply the energy of light having wave lengths within a band of 2 millimicrons by

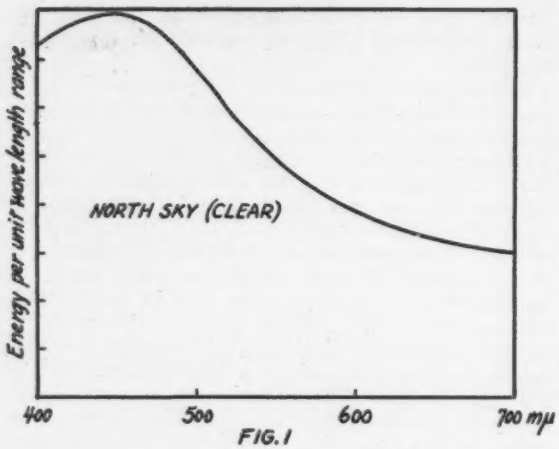


FIG. 1

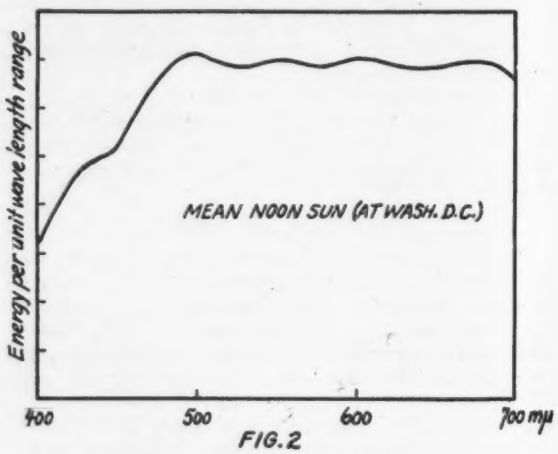


FIG. 2

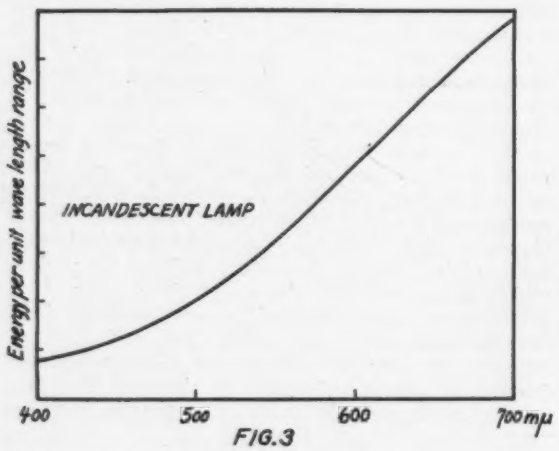


FIG. 3

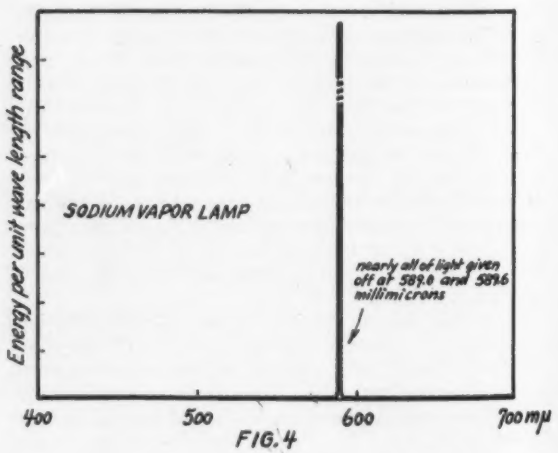


FIG. 4

the fraction of the incident light which is reflected by the colored body to the eye. This fraction depends upon geometrical factors and the "reflectance" of the body. The spectral reflectance of the body is characteristic of the body itself, and determines what the color of that body will be in *any* given illuminant. When we speak of the color of a body, we really mean the color of light coming from the body when it is illuminated by ordinary sources of light, and, as is well known, the color of objects is variable and is not purely characteristic of the objects alone. For a given geometry[2] of illuminating and viewing, spectral reflectance is the only color characteristic dependent only on the body; it is quite independent of illuminant and personal characteristics of observers.

Spectral reflectance is usually expressed in the form of a curve ("spectrophotometric curve" or "color curve") giving reflectance as a function of wave length over the range, 400 to 700 millimicrons. Reflectance is the ratio, for the same geometry and wave length of monochromatic light, of the amount of light reflected by the sample to that reflected from a pure and properly prepared surface of magnesium carbonate or magnesium oxide. It is thus a relative quantity and is correctly termed "apparent reflectance", although in common usage it is simply referred to as "reflectance". No error arises in color specification from spectral reflectance curves if one is consistent in the use of, say, magnesium carbonate of constant absolute reflectance.

Color measurement, then, consists most fundamentally in taking measurements of spectral reflectance. In a spectral reflectance curve, "color" is resolved into its components, and, as will be shown in the following section, this fundamental color analysis can lead to technological advances which could not be accomplished with the naked eye. While the physiological reactions in the human eye to various light stimuli are wonderful, the eye, unlike the ear, cannot make estimates of how energy is distributed among wave lengths: it is impossible, by simply viewing a colored light, to see whether the illuminant is monochromatic or heterogeneous in structure, or to make any estimate of the nature of the spectral energy distribution. The connection between a spectral reflectance curve and the color of an object as seen by a standard observer in any given illuminant has been established. This is made the subject of Section VI; there it will be shown how dominant wave length or "hue", purity or "saturation", and luminosity may be obtained for any illuminant. In Section II it is shown that important technological advances could be made in the paper industry through direct use of the spectral reflectance curves.

SECTION II

Use of Color Analysis in the Manufacture of Pulp and Paper

The applications of spectral reflectance and spectral transmittance measurements in the pulp and paper industry may be divided into three major groups: (*a*) color specification of pulp, filler, and other components of the furnish, and of the finished paper; (*b*) routine testing and control of mill processes; and (*c*) development or research work.

[2] By geometry is meant angle of incidence and angle of viewing.

Color Specification

The only color characteristic of a "white" or colored sheet of paper which is dependent upon the sheet alone is the spectral reflectance curve. The color, as pointed out in Section I, depends upon both the nature of the illuminant and the spectral reflectance curve. Hence the most fundamental, and complete, color specification is the spectral reflectance curve. For a standardized geometry of illuminating and viewing (e.g., incident light at 45 degrees, reflected light at 90 degrees with the surface), two samples will match under *all* illuminants if their spectral reflectance curves are identical. It does not follow, as corollary to this statement, that two samples will never match if their spectral reflectance curves are not closely similar; rather, as a result of traditional dyeing practice, it is common to find samples having quite different spectral reflectance curves which match satisfactorily under some *one* illuminant. It does follow from theory and experience, however, that two samples having appreciably different spectral reflectance curves will not match under all illuminants. If, as is usually the case, it is considered expedient to arrive at a commercial match for daylight, the color specification can be obtained from the spectral reflectance curve in psychological terms, for daylight, by means of the I. C. I. system of color specification described in Section VI. This specification does not impose strict requirements on the spectral reflectance curve; indeed, two samples which have the same I. C. I. specifications for daylight and match to the eye of the hypothetical standard observer may have quite different spectral reflectance curves. Where this is the case, however, the match may be very poor under illuminants like north sky light or artificial light, which are greatly different from average daylight.

A spectral reflectance curve accompanied by a notation on the geometry of illuminating and viewing will serve as a permanent color record. The value of a file of such records should be very great.

Color specification should be extended to highly bleached pulps, white papers, and white fillers, since such substances are rarely achromatic, and usually possess definite hue. All experienced mill men are familiar with this fact, but occasionally forget to make proper allowance for hue when attempts are made to compare the visual brightnesses of two samples having perceptibly different hue; as a general rule, the more achromatic or neutral samples will be favored. Color specification on the I. C. I. system is rather difficult in the case of neutral grays, and it is more satisfactory to deal directly with the spectral reflectance curves, which exhibit important differences.

Questions are often raised regarding the important problem of color tolerances. While some work has been done on this problem in other industries, nothing of any general value has been done on this question for the paper industry. The establishment of color tolerances presupposes that photoelectric instruments will measure smaller differences than can be detected with the human eye. The question regarding this point is often raised. It may be stated, in answer to this question, that a photoelectric spectrophotometer is capable of measuring differences in spectral reflectance which are very considerably smaller than those corresponding to perceptible differences in color. A well-designed photoelectric

spectrophotometer has a reproducibility of approximately 0.2 per cent; as a general rule, it is very difficult visually to differentiate between two samples whose spectral reflectance curves differ over the whole visible spectrum by as much as two per cent of actual values.

Routine Testing and Control of Mill Processes

It is very well known among paper makers that the color of the finished paper depends upon many, possibly all, of the variables of paper making. Certainly the color characteristics of the finished sheet depend upon those of the pulp, dye stuffs, fillers, size, and other material components of the furnish. Beating and refining affect the color to a marked degree. *p*H (by affecting the retention of dye and filler), retention of "fines", consistency, and the remaining variables up to the calanders influence the color characteristics of the finished paper. The "darkening" produced by calendering should be considered as a change in color characteristics.

With the help of a good photoelectric instrument, the effects of the numerous variables upon the spectral reflectance curve can be studied in detailed fashion. The precision of well-designed instruments is sufficiently good to permit investigation of effects produced by relatively unimportant variables. It would seem that a through study of the effects of at least the more important variables would lead to economies. It is known, for example, that *p*H has an optimum value for maximum dye retention. Of course, sheet properties other than color determine the ranges of the paper making variables; it is believed, however, that a study of variables within their respective possible ranges of variations would lead to technological improvements.

A good illustration of the application of spectrophotometry to a paper making process is found in the determination of dye retention through the use of Beer's law[3]. Concentrations of dye in the white water which are so low that the water appears almost colorless can be measured with good accuracy by this method. The spectral transmittance of the white water (contained in an absorption cell) is obtained, and the transmittance, read from the curve at the wave length of maximum absorption of light, is used in a simple calculation. A constant appearing in the equation which expresses Beer's law[3] is determined by a transmittance measurement made upon a standard solution.

An application of transmittance measurements to the determination of the end-point of a cook is suggested. Transmittance measurements would be made upon samples of the liquor. For this problem, which is purely one of routine control, an expensive spectrophotometer would not be necessary, since a simple photoelectric "colorimeter"—an instrument equipped with filters and designed especially for transmittance measurements—would probably be found satisfactory.

It has been established that the cost of white papers correlates very well with the reflectance at wave lengths in the neighborhood of 450 to 460 millimicrons.[4] The term "brightness" has been adopted for reflectance at a wave length of about 458 millimicrons, as measured on a calibrated General Electric Reflection Meter. If the visual brightness of white paper is increased by any one, or a combination, of several operations, it is found that reflectance in the blue and violet part of the spectrum is very much more increased than are reflectances at greater wave lengths; indeed, certain changes in sheet properties profoundly affect "brightness" (both instrumental and visual) of white papers without causing appreciable change in reflectance at wave lengths in excess of roughly 600 millimicrons. As a result of these findings, brightness measurements are used extensively in routine testing of the finished paper and of such components of the furnish as fillers.

Needless to say, one cannot expect the instrumental brightness of a dyed or colored sheet to express the visual brightness; visual brightness or luminosity (for a given illuminant) can be calculated from the spectral reflectance curve in accordance with the methods outlined in Section VI.

A brightness measurement is, of course, not a color measurement, and hence one must be cautioned against attempting to use brightness values alone in connection with colored papers, or even to use brightness values for expression of the color of white or near-white papers. There are, however, two important color changes in white papers which can be given adequate expression by brightness values. These color changes are associated, respectively, with bleaching of the pulp, and the aging of the paper. The spectral reflectance curve of a typical unbleached sulphite pulp starts at a relatively low value at 400 millimicrons (extreme violet), rises rapidly and smoothly in the blue region, and tends to level off to a fairly high value at 700 millimicrons (extreme red); the color is a yellow of low purity, or light buff. After the bleaching process the spectral reflectance curve is higher throughout the whole spectrum, but the rise of the curve in the blue and violet is considerably greater than that for any other portion of the spectrum. Hence, in the routine testing of bleaching, brightness determinations are of considerable value. An increase in brightness as a result of bleaching means increased visual brightness, reduced purity of yellow, and increased whiteness.

When white paper ages, either naturally or by the accelerating action of elevated temperatures, the spectral reflectance curve decreases throughout the whole spectrum, but again, the change in the blue and violet region is considerably greater than that of any other portion of the spectrum. Consequently, brightness measurements alone are very effective in routine tests of permanence of color of white papers. They are of similar value in the testing of the "fading" of white papers as the result of insolation or irradiation by ultra-violet light. Where the permanence of color of *colored* papers is studied, one must be cautioned to deal with the spectral reflectance curve, and not with any single reflectance value. It is possible that preliminary work with the spectral reflectance curves will suggest one, two, or three wave lengths at which reflectance values will suffice for routine testing; it is advised, however, that the whole spectral reflectance curve be used in tests on colored sheets.

In the routine testing of the color of the finished

[3] The transmittance of a glass cell containing a dissolved substance of the concentration c, is, when corrected for reflection losses, e^{-ac}. The measurement is made with monochromatic light; if the wave length is constant, a is a constant; a is a function of thickness of the solution and of the wave length. Usually the wave length for which a is a maximum is chosen for measurements.

[4] Grading brightness is reflectance obtained on a General Electric Reflection Meter calibrated at, and maintained in calibration through a monthly checking service rendered by The Institute of Paper Chemistry, with the No. 1 filter before the photoelectric cell. The effective wave length of the No. 1 filter is 458 millimicrons.

paper, a photoelectric instrument designed to obtain spectral reflectance curves should at least serve as a valuable aid to the experienced color man. At night, or at any other time when daylight is not available, the spectral reflectance curves will show whether the color is constant or varying. In this application of photoelectric instruments it is not necessary that the fundamental accuracy of the spectral reflectance measurements be high; but it is necessary that precision in reproducibility be good, for the important objective in controlling color is the precise measurement of *differences* in spectral reflectance.

In connection with the problem of routine control of color, the paper maker often asks how the color man can learn from the spectral reflectance curves to make changes which will result in constant color characteristics. With experience, it should be possible for one to associate absorption maxima (minima in the curves) and shapes of the curves with dye stuffs, and magnitude of changes in the curves with weight of dyeing. With such experience, the spectral reflectance curve of a submitted sample should greatly aid the color man in choosing his dyestuffs to bring about a satisfactory match. This procedure would tend to minimize the amount of broke sent to the beater, and to bring about color matches which would hold under more than just one illuminant.

Development or Research Work

Because of the nature of research, which involves original work, it is impossible to sketch here all of the possibilities for mill research in color and in spectral absorption measurements made upon liquids. Through the use of spectral reflectance measurements, improvements have been made in the use of fillers. There are indications of improvements through the study of spectral opacity (contrast ratio) and of spectral transmittance of transparent and opaque papers. Studies of aging by heat and light should lead to greater permanence of color. Improved dye retention and reduced dye losses might be expected to result from a research on retention. There are, of course, many possible researches that may be carried out in the mill with the aid of good photoelectric color instruments.

As an illustration of what can be done with the theory of absorption and scattering of light in paper, a research recently carried out at The Institute of Paper Chemistry showed that it is possible to compute the spectral reflectance curves of hand sheets dyed with various weights of dye mixtures. This work strengthens the belief that a photoelectric instrument for the measurement of spectral reflectance would greatly aid the color man in arriving at improved color matches (not by computation necessarily) and in keeping the color of paper from the machine constant.

SECTION III

Methods for Physical Measurement of Color

A true analysis of the color of a body may be obtained only by measuring the distribution of energy among the wave lengths of light reflected by the body relative to that of light reflected by an ideal white. In short, a spectral reflectance curve must be obtained. If the body is transparent, a spectral transmittance curve is obtained if color analysis of transmitted light is desired. Where color specification for a given illuminant is considered adequate, it should be possible *theoretically* to obtain by measurement and computation such specification with a three-filter photoelectric method. The various methods for color measurement are differentiated in the chart of Fig. 5.

The several photoelectric methods may be divided into two main groups, the first composed of methods in which the light entering the photoelectric cell is monochromatic (spectrophotometers), while in the second group the wave lengths of the light cover appreciable bands; in the monochromatic methods the light is dispersed by one or more prisms, and in the non-monochromatic methods the wave length bands are isolated by means of optical filters or prism dispersing systems designed to pass appreciable wave length bands. If the filters used are stenochromatic (pass narrow wave length bands), a fair approximation to monochromatic light is obtained.

Further differentiation between the methods is made on the basis of position of the monochromatizing system; in one group, the light incident upon the sample is composed of all wave lengths of the visible spectrum and the reflected light is rendered monochromatic, in another group the incident light is monochromatized, and in a third possible group both the incident and reflected light would be monochromatized. A similar differentiation (into two groups) may be made between those methods in which three wide wave length bands are used.

The geometry of illumination and "viewing" may be any one of four geometries, or a hybrid combination of these. The first is that recommended in 1931 by the International Commission on Illumination (I.C.I.). In this geometry the incident light falls upon the sample at an angle of 45 degrees, and the line of viewing is perpendicular to the sample. In the second geometry the incident light is normal to the sample and the line of viewing is at 45 degrees with the sample. In a third, the incident light is normal to the sample and viewing is accomplished over all angles of a hemisphere by means of an integrating cavity. In the fourth geometry, the incident light is diffused by means of an integrating cavity, and the line of viewing is normal to the sample.

To measure reflectance it is necessary to illuminate the test sample, and then to illuminate a standard of reflectance. Reflectance is measured relative to that of an arbitrary standard. The I.C.I. standard is a properly prepared surface of magnesium oxide, and such a standard is arbitrarily assigned a value of 100 per cent. The measurement of reflectance, then, may be accomplished by either of two broad methods: (*a*) the intensities of the light reflected from the sample and standard are measured and compared, or (*b*) the intensity of the light incident upon the standard, or of the light reflected from the standard, is reduced in known fashion until the intensity of the light from the standard to the photoelectric cell is exactly the same as that from the sample. In method *(a)* it is necessary that the photoelectric current be directly proportional to the light flux entering the photoelectric cell (linear response), or that the functional relationship between light flux and photoelectric current be known. In methods (*b*) the photoelectric cell need not satisfy the drastic requirement that its response be linear with light flux, but must satisfy only the one requirement that, with-

in a short period of time, the same light flux will consistently give rise to the same photoelectric current. Methods (*b*) are generally preferred over method (*a*) because light intensity can be controlled with an error smaller than that involved in the assumption that the response of a photoelectric cell (even of the vacuum type) is linear. The first five methods given under "Photometry" in the chart of Fig. 5 are of type (*b*). The first of these involves a property of light known as polarization. If light is polarized by means of a Nicol prism or other similar polarizing prism, and is then caused to pass through a second polarizing prism, it is found that the intensity of the light after passage through both prisms depends upon the relative angle of rotation (about direction of light beam) between the two prisms; if the angle between the axes of the prisms is 90 degrees, no light is passed, and when the angle between the axes is zero, the intensity of the transmitted light is maximal; the mathematical relationship between the relative angle of rotation and the intensity of the light after passage through the polarizing prisms is known and exact. Usually a Nicol or similar prism and a Wollaston prism are used in conjunction. A Wollaston prism has the property of splitting a beam of light into two beams of polarized light with the directions of polarization mutually perpendicular. One of the beams is directed upon the standard, and the other upon the sample. Rotation of the Nicol prism, which is placed before the Wollaston, changes the relative intensities of the light on the standard and sample in accordance with a precise and well established law. When the intensity of the light reflected from the sample is the same as that reflected from the standard (as determined by a photoelectric cell) the adjustment is proper, and reflectance is obtained from the angle of rotation of the Nicol prism. In one modern photoelectric spectrophotometer[5] this type of photometry is employed, and the machine automatically balances the light reflected from the standard with that reflected from the sample, wave length by wave length, throughout the visible spectrum; through the agency of a special cam, the machine properly translates angle of rotation of a polarizing prism into reflectance units, and reflectance is recorded on a sheet of graph paper.

Sector and iris diaphragms may be used for controlling the amount of light flux which falls upon, or is reflected by, the sample and standard. The sector diaphragm is a mechanical device permitting light to pass through one or more pie-cut shaped openings. The light flux passing through a sector diaphragm is, ideally, proportional to the angular opening, while that passing through an iris diaphragm is, ideally, proportional to the area of the variable circular opening. A sector diaphragm will give strictly accurate results when the intensity of light is constant around any circle concentric with the diaphragm; the in-

[5] The General Electric Recording Spectrophotometer.

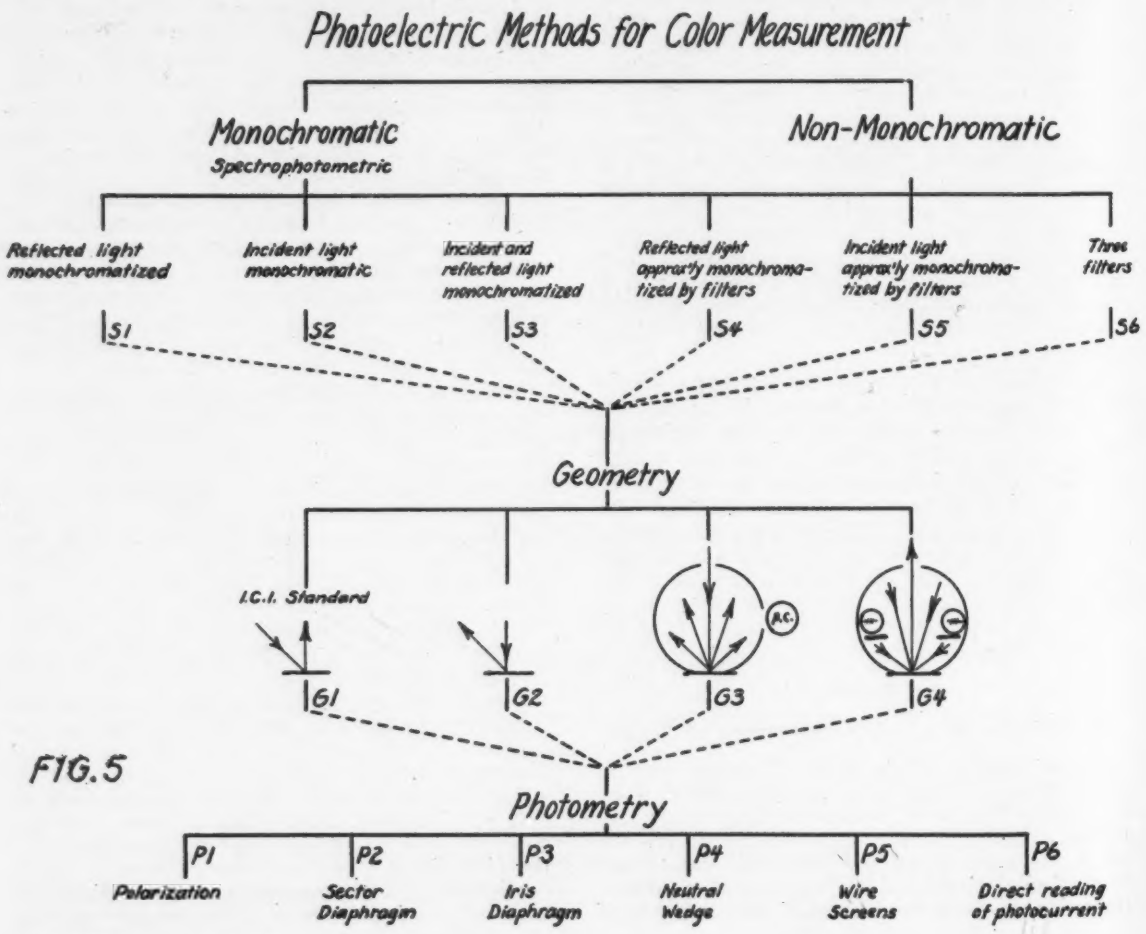


FIG. 5

tensity may vary with distance from the center. The condition for accurate results with the iris diaphragm is considerably more severe, for the intensity of light falling on all points in the active area of the iris diaphragm must be constant.

The neutral wedge and wire screens are not usually employed in photoelectric instruments, although they can be used in such instruments for controlling light flux. The neutral wedge is literally a wedge of transparent but absorbing material. The material must be truly achromatic, that is, it must not selectively absorb light of different wave lengths. For precise control of light flux, the light beam must pass through the wedge in the form of a narrow ribbon with the narrow dimension in the direction of the angle of the wedge. The transmission of such a wedge varies exponentially with the thickness of the wedge; in actual use, a calibration chart should be used. Wire screens are blackened wire cloth or mesh. The intensity of the light falling upon the screen, or the spacing in the screen itself, must be uniform from point to point, and the rays passing through the screen should be perpendicular to the screen. The screens must be calibrated and suffer the disadvantage that only discontinuous variations in light flux may be made.

The main purpose of this selection is to classify, and broadly to describe the essential features of the various photoelectric methods for color measurement. Quite naturally, there are a number of variations in each of the subsidiary methods shown in the chart of Fig. 5. Putting aside these variations, one is left to contemplate many possible instruments; the number indicated in Fig. 5 is 144. While it may seem that many of the variations are trivial, actually this is not the case, as will be shown in the detailed critique given in Sections IV and V. Two instruments may differ, for example, only in geometrical details. One of these instruments will not necessarily be more, or less, fundamentally accurate than the other, but the differences in geometrical details are important, since such details, among others, define the measured reflectance or transmittance values. In general the design of an instrument defines the reflectance or transmittance measured.

The chart of Fig. 5 should be useful for rapid classification of the method of any particular instrument. It will be noted that the spectral types have been given the numbers S1, S2, . . . , S6, geometrical types G1, G2, G3, G4, and photometric types P1, P2, . . . , P6. As illustrations, we may take the new General Electric Recording Photoelectric Spectrophotometer, which, according to the chart, is of the type S2-G3-P1, and the first model of this machine, which is of the type S2-G2-P2; the General Electric Reflection Meter ("brightness tester") is of the type S4-G1-P2.

(To be concluded)

Northern Mill Superintendents Meet

[FROM OUR REGULAR CORRESPONDENT]

WAUSAU, Wis., October 25, 1937—S. E. Tomczak, of the Flambeau Paper Company, Park Falls, Wis., was elected chairman of the Northwest division of the American Pulp and Paper Mill Superintendents' Association at its fall convention here October 15 and 16. He succeeds R. W. Meyer of the Badger Paper Mills, Inc., Peshtigo, Wis. Other officers chosen are: Frank Pelot, Nekoosa-Edwards Paper Company, Port Edwards, Wis., first vice-chairman; George Peterson, Mosinee Paper Mills Company, Mosinee, Wis., second vice-chairman; L. E. Parkinson, Flambeau Paper Company, secretary-treasurer.

Total registration included 159 members of the division and 37 women guests. The opening day was given over to inspection of mills in the Wisconsin Valley section, golf in the afternoon, and an informal stag dinner. The women were entertained at a luncheon, a sightseeing trip and a theater party.

Business sessions were held all day Saturday, October 16. One of the interesting papers presented was that of G. J. Brabender, chemical engineer of the Marathon Paper Mills Company, Rothschild, Wis., on "Weight and Caliper Variation Across the Paper Machine." Another on "Beater Control" was presented by Dr. Walter Hoffman of the Northwest Paper Company, Cloquet, Minn.

Dr. Hoffman displayed his company's plan of beater room and machine room records whereby the beater room operatives keep a record of all chemicals and wood materials entering the mix; also the temperature from hour to hour, the acidity, and reasons for changes in the mix. These data are valuable to the accounting department as well as the production department, Dr. Hoffman said.

G. W. Craigie of Cumberland Mills, Me., national secretary of the American Pulp and Paper Mill Superintendents Association, was one of the guests of the convention. He declared the future of the paper industry promises to be phenomenal through the development of many new products made from fiber to take the place of metal, stone and other materials. Concern for production has given way to a demand for speed, he pointed out. Machine and equipment builders therefore have done twice as much in the last five years to further the production of fine papers at high speed than in any previous decade. The industry is also becoming "waste conscious," and is doing more than ever before to salvage valuable raw material and chemicals.

Among the topics covered in the discussions were: the changing of the crown on rolls to overcome porosity variations; speeding up of beaters by using bed plates with small round holes; effects on production by placing the suction press ahead of the main press of the Yankee machine; the use of cellite in beaters to disperse pitch, and the reduction of dirt and slime to improve quality. Use of an electric eye was suggested as a felt and wire gauge.

The convention closed with a banquet for the members and their wives at the Elks auditorium, with Roy H. Kelly of the Marathon Mills as toastmaster. Dancing followed.

Book Paper Broadside by Bare

Latest D. M. Bare Paper Company broadside is entitled "Why Authors," and shows the portraits of Chaucer, Ruskin, Tennyson and Whittier on the front cover.

On the two inside pages the question is logically answered and a brief description is given of these authors as well as the four grades of book paper manufactured under these trade names by the D. M. Bare mill.

Test sheets and samples are then offered the trade on the back page.

A Guide To Labor Relations

WHAT ARE MY RIGHTS?—An Employers' Guide to Labor Relations, by Daniel Harris (A. B. 1907; LL.B. 1909 Harvard,) member of the Boston Bar, a corporation lawyer for twenty-seven years' experienced, in collaboration with Jerome Daniel Goodman (A.B. 1934 St. John's College; LL.B. 1937 Harvard.

This work embodies the practical experiences of a man who has devoted much time and effort to the representation of employers in labor disputes plus the results of numerous case experiences under the National Labor Relations Act (the Wagner Act), together with a brief summary of the various decisions on labor that have been made by outstanding Courts. Included also in the latter half are brief analyses of the Norris, LaGuardia Anti-Injunction Act, and typically similar Acts now in force in Massachusetts. Among the matters treated are conditions of the past, when employers dealt with individuals, the rise of the union, the struggle of class versus class, and the strike.

Because of favorable legislation, better education as to its inherent powers, violent and dramatic leadership, much of it insincere, and favoring business conditions, labor has advanced to new positions. By the same token the employer has lost many of his former advantages. Without benefit of reasonable restraining legislation: without a depression in business; with public opinion not yet sufficiently aroused to crystallize into a real wave of public resentment, the employer has little equipment with which to trade. His choices are few.

If, in order to avoid a war of commercial extermination, in which the stakes are rarely worth the sacrifice, it becomes expedient to effect trade agreements, the employer is amply justified, because of the ruinous precedents of the immediate past, to seek to restrain by agreement, certain unfair trade practices by labor, so that industrial strife may occur only after hesitation and matured and considered deliberation, and only on major issues.

Mr. Harris makes several practical suggestions with reference to the matter of restraint, among the more striking of which are demands by employers for the privilege of presenting their grievances directly to the body of workers in the event that they receive no redress at the hands of committees. This suggestion has proved of material value in the past. Unions of employers are suggested for the purpose, among other things, of formulating policies in each industry with reference to labor well in advance of possible strife; insistence upon outlawing strikes for petty vindication; that the intelligent employer will not wait until demands are made upon him, but will make demands upon labor, and at a time when calm thought and time for discussion are possible. There are a number of other practical safeguards which can be put into agreements, all of which are discussed, and which will ultimately lead to the quieting of strife during any given period.

"Tergitol", Makes Water Wetter

The old comparison "like water off a duck's back", will no longer be appropriate if minute traces of a newly developed chemical are added to water, it was announced by Dr. B. G. Wilkes of Mellon Institute, Pittsburgh, and Dr. J. N. Wichert of Carbide and Carbon Chemicals Corporation, South Charleston, W. Va., at the recent Rochester meeting of the American Chemical Society. By the use of this new chemical, which has been trade-marked "Tergitol", water can be made to wet materials more quickly and uniformly than heretofore.

Because of the giant size of the "Tergitol" molecules, a tenth of an ounce added to a gallon of water makes the water actually "wetter", that is, the water wets whatever it touches almost instantly.

Further investigation of the properties possessed by the "Tergitol" wetting agents shows that they are very effective and quite stable under most commercial concentrations of alkaline, acid, oxidizing, and hard water conditions so frequently met with in paper processes. They are also it is said well suited for the impregnation of paper where it is desired to impart future absorbency and they have been found to serve as emulsifying agents. "Tergitol" penetrants also aid in the dispersion of lime soaps, thereby reducing the tendency of soaps to form curds in hard water. In comparison with the various soaps used as wetting agents, this new chemical is five to ten times as efficient in making water penetrate substances that are normally water-repellent.

Many profitable applications of this new compound it is stated are presented in the paper industry, since most of the operations involve the use of aqueous solutions. The "Tergitol" wetting agents will aid in the cooking, bleaching, dyeing, and sizing baths, and the speed of coating, soaking, dipping, washing and finishing of paper can be markedly increased. Further variety and volume of usage of the "Tergitol" wetting agent will be developed as the paper manufacturers become increasingly conscious of the value of "wetter" water.

New Foxboro Bulletins

"The Verigraph Moisture Controller for Control of Paper Drying," a new 20-page bulletin published by the Foxboro Company, Foxboro, Mass., describes what is said to be the only instrument that directly measures the moisture of paper on the machine. The publication explains the method by which the apparatus continuously measures the moisture content of the moving sheet of paper, and automatically operates the drier control system so that the final sheet will neither take nor lose water while in an atmosphere of specified relative humidity. In addition, it presents a discussion of problems arising from lack of moisture control in paper-making, as well as the advantages of the instrument's use in finishing, tub sizing and steam drying.

Copies of this new bulletin, No. 212, may be obtained by writing the Pulp and Paper Division of the Foxboro Company, Foxboro, Mass.

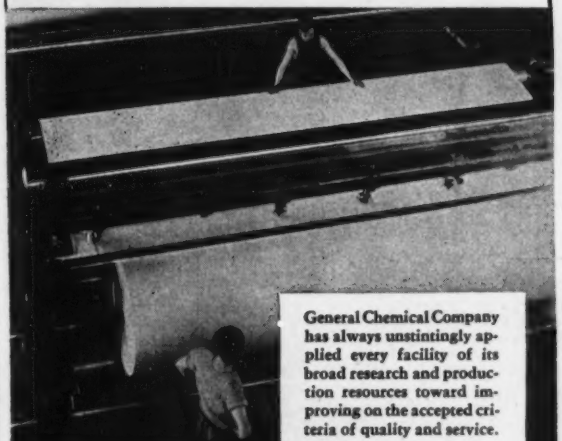
"Stabilog Process Control in Industry," a new 32-page booklet published by the Foxboro Company, Foxboro, Mass., describes a unique system of automatic control of temperature, pressure, level and flow in continuous processes, which takes into consideration the rate of change of the condition being controlled. The booklet is well illustrated with photographs of industrial plant applications of the system. Explanatory notes demonstrate the characteristic features of Stabilog Controllers, such as its automatic reset mechanism which allows the instrument to balance out at the control point with the valve in any position demanded by the process.

Copies of the new bulletin, No. 175-1, may be obtained from the Foxboro Company, Foxboro, Mass.

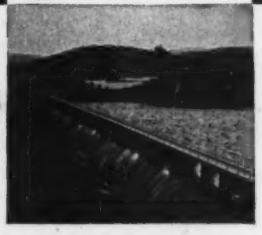
aluminum sulphate

As it was first manufactured, early in the 19th century, Aluminum Sulphate was an impure product of very limited usefulness. However... as soon as methods were devised for removing iron and other undesirable impurities... Aluminum Sulphate, because of its higher alumina content and lower cost, began to replace crystal alums in most industrial applications. ● Today Aluminum Sulphate is the cornerstone of many basic processes in water purification, sewage disposal, paper and textile manufacture.

General Chemical Company has for many years manufactured Aluminum Sulphate of an alumina strength consistently above accepted standards ... and in a variety of grades that amply fulfil all industrial requirements.



General Chemical Company has always unstintingly applied every facility of its broad research and production resources toward improving on the accepted criteria of quality and service.

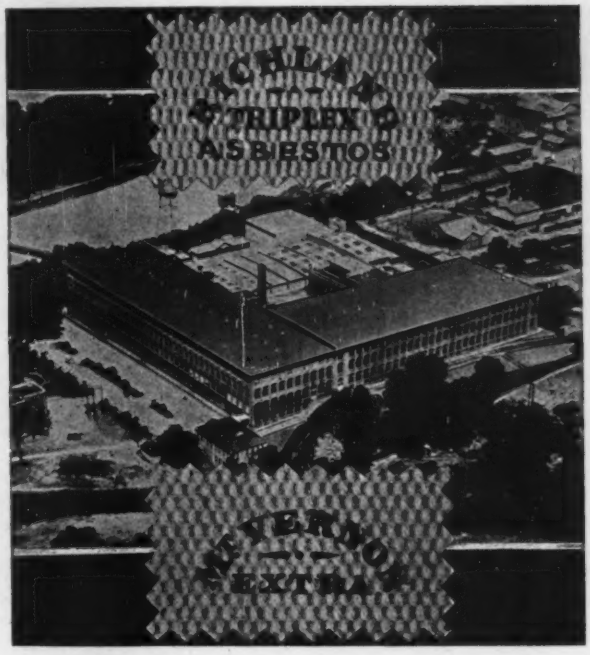


GENERAL CHEMICAL COMPANY

Executive Offices: 40 Rector St., New York, N. Y.

Sales Offices: Atlanta • Baltimore • Boston • Buffalo • Charlotte Chicago • Cleveland • Denver • Kansas City • Los Angeles Minneapolis • Montezuma (Ga.) • Philadelphia • Pittsburgh Providence • San Francisco • St. Louis • Wenatchee • Yakima In Canada: The Nichols Chemical Co., Ltd. • Montreal • Toronto

Acids • Alums • Sodium Compounds • and Other Industrial Chemicals



We Invite YOU to Know Us *Better!*

● Standing between your needs for dryer felts and the vast cotton fields of the South, is this great unit of Mt. Vernon-Woodberry Mills.

● Endowed with all that nature can bestow upon it . . . fine water . . . proximity to raw materials . . . a temperate balanced climate . . . a degree of uniformity in product becomes attainable here that less favorable conditions could not make possible. Operating within these walls the most modern mill equipment man has yet conceived, skilled workers are guided by more than half a century's experience which Mt. Vernon-Woodberry Mills build into every fabric that bears their name.

● When you specify RICHLAND TRIPLEX asbestos or all cotton or MT. VERNON EXTRA, you receive in dryer felts all that nature and all that man has thus far been able to provide.

MT. VERNON-WOODBERRY MILLS, INC.

TURNER HALSEY COMPANY

40 WORTH STREET *Selling Agents* NEW YORK CITY

Branch Offices: SAN FRANCISCO • NEW ORLEANS • CHICAGO • BOSTON • BALTIMORE

Imports of Paper and Paper Stock

Giving Manifests of New York, Boston, Philadelphia and Other Ports, of Newsprint, Wrapping, Writing, Coated, Blotting, Tissue, Strawboard, Wallboard, Cigarette Papers, Sulphite, Kraft and Ground Wood Pulp.

NEW YORK IMPORTS
WEEK ENDING OCTOBER 23, 1937

SUMMARY

Cigarette paper .....34 cs.
Wall paper .....5 cs.
Paper hangings .....15 bls., 2 cs.
Newsprint .....14,688 rolls
Printing paper .....8 cs.
Wrapping paper .....8 cs.
Drawing paper .....4 cs.
Filter paper .....24 cs.
Metal coated paper .....7 cs.
Baryta coated paper .....93 sc.
Coated paper .....1 cs.
Decalcomanias .....22 cs.
Decalcomania paper .....24 drums, 40 cs.
Transfer paper .....24 cs.
Tissue paper .....3 cs.
Colored paper .....5 cs.
Writing paper .....23 cs.
Tracing cloth .....35 cs.
Paper board .....21 cs.
Straw board .....68 rolls
Miscellaneous paper .....87 cs.

CIGARETTE PAPER

Liggett & Myers Tobacco Co., *De Frasse*, Havre, 27 cs.
De Mauduit Paper Corp., *De Grasse*, Havre, 5 cs.
De Mauduit Paper Corp., *Champlain*, Havre, 2 cs.

WALL PAPER

A. L. Diament & Co., *Queen Mary*, Southampton, 1 cs.
——, *Deutschland*, Hamburg, 4 cs.

PAPER HANGINGS

W. H. S. Lloyd & Co., *American Farmer*, London, 15 bls., 2 cs.

NEWSPRINT

N. Y. Evening Journal, *Markland*, Liverpool, N. S., 631 rolls.
N. Y. Tribune, *Markland*, Liverpool, N. S., 1,957 rolls.
World Telegram, *Markland*, Liverpool, N. S., 605 rolls.
Brooklyn Daily Eagle, *Markland*, Liverpool, N. S., 150 rolls.
Westchester Newspapers, *Markland*, Liverpool, N. S., 50 rolls.
Parsons & Whittemore, Inc., *Markland*, Liverpool, N. S., 336 rolls.
Sharps Paper & Specialty Co. Inc., *Markland*, Liverpool, N. S., 231 rolls.
International Paper Sales Co., *Cornerbrook*, Dalhousie, 5,260 rolls.
International Paper Co., *Cornerbrook*, Dalhousie, 2,230 rolls.
H. G. Craig Co. Inc., *Kermic*, Donnacona, 329 rolls.
H. G. Craig Co. Inc., *A.C.D.*, Donnacona, 328 rolls.
H. G. Craig Co. Inc., *G.D.D.*, Donnacona, 392 rolls.
N. Y. Post, *Germa*, Port Alfred, Que., 736 rolls.
Jay Madden Corp., *Deutschland*, Hamburg, 362 rolls.
Perkins Goodwin & Co., *Deutschland*, Hamburg, 440 rolls.
Jay Madden Corp., *Deutschland*, Bremen, 341 rolls.
International Paper Co., *G.T.D.*, Gatineau, 310 rolls.

PRINTING PAPER

The Lafayette Co., *Laconia*, Liverpool, 3 cs.
——, *American Farmer*, London, 5 cs.

WRAPPING PAPER

Keller Dorian Paper Co., *Pr. Pierce*, Marseilles, 6 cs.
——, *Konigstein*, Antwerp, 2 cs.

DRAWING PAPER

H. Reeve Angel & Co. Inc., *American Farmer*, London, 4 cs.

FILTER PAPER

H. Reeve Angel & Co. Inc., *American Farmer*, London, 11 cs.
C. Schleicher & Schull Co. Inc., *Deutschland*, Hamburg, 13 cs.

METAL COATED PAPER

K. Pauli Co., *Deutschland*, Bremen, 4 cs.
C. H. Forsman & Co., *Deutschland*, Bremen, 3 cs.

BARYTA COATED PAPER

Globe Shipping Co., *Deutschland*, Bremen, 93 cs.

COATED PAPER

W. J. Byrnes, *Queen Mary*, Southampton, 1 cs.

DECALCOMANIAS

Phoenix Shipping Co., *Deutschland*, Hamburg, 3 cs.
——, *Deutschland*, Bremen, 6 cs.
Sellers Transportation Co., *Deutschland*, Bremen, 13 cs.

DECALCOMANIA PAPER

B. F. Drakenfeld & Co., *Laconia*, Liverpool, 24 drums, 40 cs.

TRANSFER PAPER

D. C. Andrews & Co., *Deutschland*, Hamburg, 24 cs.

TISSUE PAPER

F. C. Strype, *American Importer*, Liverpool, 4 cs.
——, *Pr. Lincoln*, Kobe, 8 cs.

TRANSPARENT PAPER

——, *Statendam*, Rotterdam, 3 cs.

COLORED PAPER

International F'd'g. Co., *Deutschland*, Hamburg, 5 cs.

WRITING PAPER

——, *Vulcania*, Trieste, 23 cs.

TRACING CLOTH

Keuffel & Esser Co., *American Importer*, Manchester, 22 cs.
C. Bruning & Co., *Deutschland*, Bremen, 13 cs.

PAPER BOARD

J. P. Heffernan Paper Co., *Black Falcon*, Antwerp, 21 cs.

STRAW BOARD

——, *Statendam*, Rotterdam, 68 rolls.

MISCELLANEOUS PAPER

——, *Koyei Maru*, Kobe, 25 cs.
R. J. Saunders, *Queen Mary*, Southampton, 5 cs.
Janan Paper Co., *Pr. Lincoln*, Kobe, 19 cs.
——, *Pr. Lincoln*, Kobe, 11 cs.
T. N. Fairbanks, *Kiyosumi Maru*, Yokohama, 5 cs.
Keuffel & Esser Co., *Deutschland*, Hamburg, 18 cs.
——, *Champlain*, Havre, 4 cs.

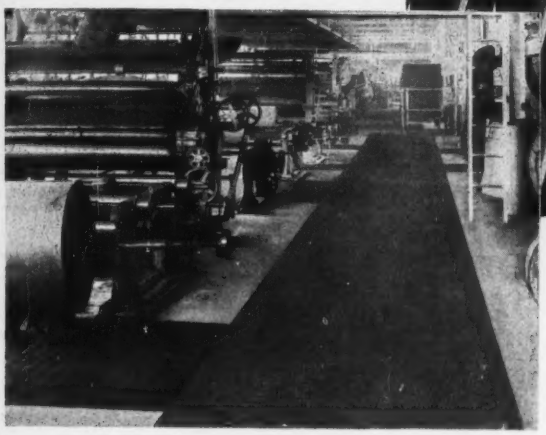
RAGS, BAGGINGS, ETC.

Irving Trust Co., *Tasmania*, Kobe, 33 bls. cotton waste.
Darmstadt Scott & Courtney, *Vigrid*, Gdynia, 59 bls. rags.
Chase National Bank, *Olympia*, B. Ayres, 36 bls. bagging.
Manufacturers Trust Co., *Olympia*, B. Ayres, 75 bls. bagging.
Darmstadt Scott & Courtney, *Pr. Pierce*, Bombay, 150 bls. cotton waste.
D. Benedetto, Inc., *Black Falcon*, Antwerp, 295 bls. rags.
Irving Trust Co., *Black Falcon*, Antwerp, 65 bls. bagging.
Manufacturers Trust Co., *Black Falcon*, 12 bls. rags.
Loumar Textile By Products, *Pipestone County*, Havre, 35 bls. bagging.
Chase National Bank, *Pipestone County*, Havre, 20 bls. rags.
American Express Co., *Pipestone County*, Havre, 62 bls. rags.

It CAN'T happen here!

● Upper right: Floor pits of NEVERSLIP over chlorination tanks of well known Pulp and Paper Mill.

● Below: NEVERSLIP Floor Plate in a large Paper Container Plant.



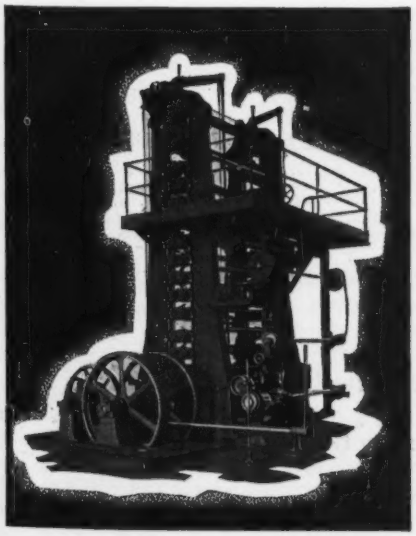
NEVERSLIP FLOOR PLATE

Modern paper mills *prevent* painful injury, sudden death . . . NEVERSLIP ROLLED STEEL FLOOR PLATE protects workers, saves management huge cost of compensation, loss of services and shattered employee moral. The "perfect diamond pattern" provides a safe, non-skid surface for foot and wheel—reduces accidents. Yet, trucks roll freely over it, and cleaning and drainage is unobstructed.

Free literature. Free sample. Write now; there's no obligation!

AMERICAN PRESSED STEEL COMPANY
Commercial Trust Building, Philadelphia, Pennsylvania

Norwood's New Finishing Machinery HELPS INCREASE PROFITS



Many of the improvements made in Norwood Finishing Machinery in the last few years will help you increase profits.

These improvements increase the active operating time of machines, reduce percentage of broke, eliminate hazards to the operator, help produce a better sheet, cut down on power consumption, reduce time and expense in roll changing, reduce roll maintenance costs, and increase the smoothness and efficiency of finishing operations.

Write for information about modernizing your finishing equipment.

THE NORWOOD ENGINEERING CO.
17 No. Maple St., Florence, Mass.

A GOOD START AND A GOOD FINISH WITH

◂NORWOOD▸

DEPENDABLE WATER FILTERS AND PAPER FINISHING MACHINERY

——, *Pipestone County,* Havre, 37 bls. cotton waste.
E. J. Keller Co. Inc., *Pipestone County,* ——, 25 bls. rags.
W. J. Green, *Statendam,* Rotterdam, 51 bls. bagging.
Hicks Costarino & Co., *Liberty,* Manchester, 48 bls. new cuttings.
——, *American Importer,* Manchester, 84 bls. paper stock.
M. Snedeker Corp., *American Importer,* Belfast, 89 bls. paper stock.
Hughes Fawcett, Inc., *American Importer,* Belfast, 50 bls. flax waste.
Chase National Bank, *Lensovet,* Leningrad, 3,126 bls. rags.
——, *Laura C.,* Trieste, 51 bls. rags.
National City Bank, *Black Osprey,* Rotterdam, 76 bls. bagging.
Van Oppen & Co., *Deutschland,* Bremen, 188 bls. paper stock.

GLUE STOCK, ETC.

American Express Co., *American Importer,* Liverpool, 620 bags hide cuttings.
——, *Alex van Opstal,* Antwerp, 255 bags hide cuttings.
——, *Vulcania,* Trieste, 800 bags ground bone glue.
——, *Vulcania,* Trieste, 100 bags bone glue sheets.

OLD ROPE

W. J. Green, *Statendam,* Rotterdam, 46 coils.
Chase National Bank, *American Farmer,* London, 52 coils.
W. Steck & Co., *Black Osprey,* Rotterdam, 54 coils.

CHINA CLAY

Whitaker Clark & Daniels, *Laconia,* Liverpool, 390 bags.
J. Dixon Crucible Co., *Deutschland,* Hamburg, 2,000 bags.

WOOD PULP

Absorbo Beer Pad Co., *Vulcania,* Trieste, 416 bls. wood pulp.
Gottesman & Co. Inc., *Sagoporack,* Hernosand, 1,200 bls. sulphate, 200 tons.
E. M. Sergeant Pulp & Chemical Co., *Sagoporack,* Hernosand, 450 bls. sulphate, 75 tons.
——, *Laura C.,* Sibenik, 4,800 bls. sulphite.
Perkins Goodwin & Co., *Belos,* Sundsvall, 450 bls. sulphate, 75 tons.
Perkins Goodwin & Co., *Belos,* Sundsvall, 1,170 bls. sulphite, 195 tons.
Gottesman & Co. Inc., *Belos,* Sundsvall, 2,700 bls. sulphite, 450 tons.
Johaneson Wales & Sparre, Inc., *Belos,* Sundsvall, 2,675 bls. sulphite, 525 tons.
Johaneson Wales & Sparre, Inc., *Belos,* Sundsvall, 200 bls. chemical pulp, 40 tons.
Mead Sales Co. Inc., *Belos,* Sundsvall, 210 bls. chemical pulp, 42 tons.
Mead Sales Co. Inc., *Belos,* Sundsvall, 315 bls. sulphite, 63 tons.
Bulkley Dunton Pulp Co. Inc., *Belos,* ——, 500 bls. sulphite, 100 tons.
Bulkley Dunton Pulp Co. Inc., *Belos,* ——, 5,200 bls. wood pulp, 1,073 tons.
——, *Belos,* Iggesund, 2,000 bls. sulphate, 400 tons.
——, *Belos,* Iggesund, 3,000 bls. sulphite, 600 tons.
Gottesman & Co. Inc., *Belos,* Halmstad, 3,250 bls. sulphite, 500 tons.
Castle & Overton, Inc., *Deutschland,* Hamburg, 775 bls. wood pulp, 155 tons.

NEWARK IMPORTS

WEEK ENDING OCTOBER 23, 1937

H. G. Craig Co. Inc., *Newscarrier,* Donnacona, 318 rolls newsprint.

ALBANY IMPORTS

WEEK ENDING OCTOBER 23, 1937

Pagel Horton & Co., Inc., *Snar,* Gefle, 12,000 bls. wood pulp, 1,400 tons.
Bank of N. Y. Trust Co., *Snar,* Waija, 2,700 bls. wood pulp, 450 tons.
Bank of N. Y. Trust Co., *Snar,* Sandviken, 3,600 bls. wood pulp, 600 tons.
Price & Pierce, Ltd., *Snar,* Sandviken, 2,700 bls. wood pulp, 450 tons.
Perkins Goodwin & Co., *Snar,* Wifstavarf, 5,250 bls. wood pulp, 888 tons.
Tradesmans National Bank Trust Co., *Snar,* Norrsundet, 3,500 bls. wood pulp, 800 tons.

PORTLAND IMPORTS

WEEK ENDING OCTOBER 23, 1937

Gottesman & Co. Inc., *Uddeholms,* Sweden, 1,000 bls. sulphite.
Pagel Horton & Co. Inc., *Uddeholms,* Sweden, 2,500 bls. wood pulp.

BOSTON IMPORTS

WEEK ENDING OCTOBER 23, 1937

Irving Trust Co., *Pipestone County,* Dunkirk, 62 bls. bagging.
Guaranty Trust Co., *Laura C.,* Trieste, 361 bls. sulphite.
——, *Laura C.,* Trieste, 750 bls. wood pulp.
M. Sone, *Birmania,* Trieste, 450 bls. wood pulp.

PHILADELPHIA IMPORTS

WEEK ENDING OCTOBER 23, 1937

——, *Laura C.,* Trieste, 750 bls. wood pulp.

WILMINGTON IMPORTS

WEEK ENDING OCTOBER 23, 1937

Pagel Horton & Co. Inc., *Ginheim,* Sweden, 2,820 bls. wood pulp.

BALTIMORE IMPORTS

WEEK ENDING OCTOBER 23, 1937

Congoleum Nairn Co., *Black Falcon,* Antwerp, 1,529 bls. rags.
S. Shapiro & Co., *Black Falcon,* Antwerp, 65 bls. bagging.
——, *Black Falcon,* Rotterdam, 540 bls. wood pulp, 106 tons.
M. Sone, *Tiradentes,* Rotterdam, 1,800 bls. wood pulp.
M. Sone, *Maasdam,* Rotterdam, 3,000 bls. wood pulp.
Pagel Horton & Co. Inc., *Milos,* Sweden, 1,500 bls. wood pulp.
Parsons & Whittemore, Inc., *City of Hamburg,* ——, 778 bls. wood pulp.

CHARLESTON IMPORTS

WEEK ENDING OCTOBER 23, 1937

E. J. Keller Co. Inc., *Fluorspar,* ——, 162 bls. bagging.

NEW ORLEANS IMPORTS

WEEK ENDING OCTOBER 23, 1937

M. Sone, *Tabor,* Sundsvall, 4,200 bls. wood pulp.
E. J. Keller Co., Inc., *Maria,* ——, 222 bls. paper stock.

HOUSTON IMPORTS

WEEK ENDING OCTOBER 23, 1937

Darmstadt Scott & Courtney, *Vigrid,* Gdynia, 228 bls. rags.

GALVESTON IMPORTS

WEEK ENDING OCTOBER 23, 1937

M. Sone, *Joliet,* Hamburg, 498 bls. wood pulp.

MONTREAL IMPORTS

WEEK ENDING OCTOBER 23, 1937

Pagel Horton & Co. Inc., *Aakre,* Sweden, 30,135 bls. wood pulp.

Blake, Moffitt & Towne To Be Agents

Blake, Moffit & Towne of San Francisco and their branch houses in Los Angeles, Portland, Seattle and Tacoma have taken on the agencies for Hurlbut Paper Company's Mould Made Cover and will have the exclusive distribution of this new and attractive cover paper on the Pacific Coast.

Appleton
FELTS
Are 1937 aids to making good paper . . . . . .
THE MARK OF QUALITY
APPLETON WOOLEN MILLS, APPLETON, WIS.

Enduring Utility

CRODON
The Chrome Plate

LONG after ordinary equipment has been discarded, chromium-plated parts continue in regular operation. Protection against wear and corrosion does more than simply prolong useful life . . . . it maintains new-equipment efficiency for extended periods.

THIS unusual performance means nothing less than drastically reduced costs, coupled with increased operating efficiency and improved quality of product—all important factors in the renewed competition for business.

The trade-mark CRODON assures the best in chromium plate

Your own investigation of CRODON should be decidedly worth while, judging from the experience of many representative companies whose substantial cost-reductions and trouble-free operations are consistently attained with the aid of CRODON plate.

Chromium Corporation of America

Executive Offices—120 Broadway, New York

P. O. Box 1546
Waterbury, Conn.

3125 Perkins Ave.
Cleveland, Ohio

4645 West Chicago Ave.
Chicago, Ill.

New York Market Review

Office of the PAPER TRADE JOURNAL,
Wednesday, October 27, 1937

The wholesale paper markets report demand for some grades of paper as slightly improved for the week. The opinion in general is that inventories are now being reduced to such an extent that any buying cannot be postponed much longer. A gradual, steady improvement in volume is expected for the balance of this year. In general, prices remain firm.

The newsprint market is active, with contract shipments moving in normal volume.

Writing papers are stated to be under the influence of a rather light consumer demand, but conditions are somewhat better for the current week. Ledgers and rag papers reflect an improved demand. Book papers continue moderately active, with the trade receiving more inquiries, indicating an improved demand for the future.

The tissue paper market reports no change in demand and activity remains relatively slow. The expected seasonal improvement in volume for the holiday days has not, as yet, set in.

The demand for kraft papers is more active for this week, with an increase in orders of about 15 per cent. The box board market continues less active than seasonal.

Chemical Pulp

The chemical pulp market is at about the same level as the preceding week, with the possibility of a slight decline in demand and prices for so-called spot tonnage. This is stated to be due, to some extent, to the recent reported curtailment in the production of kraft paper and board. The decline in business in general is also a factor.

Mechanical Pulp

The demand for mechanical pulp is reported to be somewhat less for this week. Prices are not affected by the slight decline in chemical pulp and remain unchanged.

Old Rope and Bagging

The demand for old rope and bagging continues on substantially the same level as last week. Prices for domestic bagging are unchanged, while the quotations on foreign bagging remain firm. No change is reported in domestic or foreign manila rope and jute threads.

Rags

The domestic rag market is relatively quiet, without change in prices. Little activity is reported in foreign rags.

Waste Paper

The waste paper market is unchanged for the current week. Prices of the lower grades are less firm than the higher grades.

Twines

The demand for twine is slightly under that of a week ago. Prices on many grades show a slight decline for the current week.

Government Paper Bids

[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON, D. C., October 27, 1937—The Government Printing Office has received the following bids for 41,100 pounds (450,000 sheets) of No. 2 kraft wrapping paper; Enterprise Paper Company, 4.336 cents less 2 per cent; Reese & Reese, Inc., 4.41 cents; Mathers-Lamm Paper Company, 4.51 cents; Walker, Goulard Plehn Company, 4.75 cents less 2 per cent; Old Dominion Paper Company, 4.75 cents less 2 per cent; R. P. Andrews Paper Company, 4.65 cents; Barton, Duer & Koch Paper Company, 4.41 cents; Stanford Paper Company, 4.65 cents; Graham Paper Company, 4.75 cents; and Whitaker Paper Company, 4.34 cents.

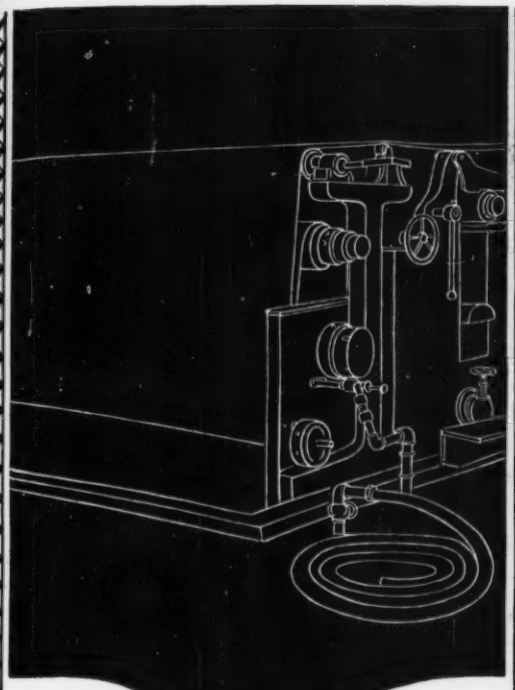
For 3,000 sheets of 24 by 36 brown cloth lined paper; Andrews Paper House of N. Y., $133.61 per M sheets; Stanford Paper Company, $133.00; Reese & Reese, Inc., $130.09 and $129.93; Charles W. Beers & Company, $133.00; Walker, Goulard, Plehn Company, $130.00; Resolute Paper Products Corp., $136.06; Barton, Duer & Koch Paper Company, $130.83; R. P. Andrews Paper Company, $132.40; Whitaker Paper Company, $129.58 and $129.42; and Mathers-Lamm Paper Company, $127.25 and $129.40.

For 8,000 pounds (40,000 sheets) of jute or superpurified wood tag board; Whitaker Paper Company, 8.57 cents; Reese & Reese, Inc., 7.7 cents and 7.46 cents; R. P. Andrews Paper Company, 7.7 cents; Barton, Duer & Koch Paper Company, 8.3 cents; Old Dominion Paper Company, 7.49 cents; Mount Holly Paper Company, 7.97 cents; and L. Hyman & Sons, 7.75 cents.

For 330,000 pounds of U. S. postal card bristol board; R. P. Andrews Paper Company, 5.9 cents per pound; and Whitaker Paper Company, 5.9 cents.

Central Paper Co. Earns $4.59 Per Share

The Central Paper Company, Inc. reports as follows for the year to June 30: Net income, $326,309, equal to $4.59 each on 71,058 preferred shares, against $141,303, or $1.97 each on 71,573 shares, in year to June 30, 1936.



NOT QUALITY ALONE

It's not only the superiority of the felt itself that has earned Orr its enviable reputation. It is also the ability of Orr representatives to select the right felt for the job.

Such ability, of course, comes only with experience . . . the kind of experience gained through years of contact with mill men and their problems . . . the kind that may be of help to you.

When the Orr representative calls, don't hesitate to discuss your felting problems. A bit of advice might save you thousands of dollars annually.

THE ORR FELT AND BLANKET COMPANY
Piqua, Ohio

ORR FELTS

NATIONAL
Paper Dyes

DYES FOR COLORED NEWSPRINT

Pink and Peach

National Safranine AP Conc.
Chrysoidine YP Conc. New
Chrysoidine RP Extra

Green

National Victoria Green
WBP Crystals

NATIONAL ANILINE AND CHEMICAL COMPANY, INC.

40 RECTOR STREET NEW YORK, N. Y.

BOSTON
PROVIDENCE
CHICAGO
PHILADELPHIA
SAN FRANCISCO
CHARLOTTE
GREENSBORO
ATLANTA
CHATTANOOGA
PORTLAND, ORE.
TORONTO

Branches and Distributors throughout the World

NATIONAL N DYES

Miscellaneous Markets

Office of the PAPER TRADE JOURNAL,
Wednesday, October 27, 1937.

BLANC FIXE—The demand for blanc fixe is normally active. Prices are firm and conform to the quotations of last week. The pulp is offered at from $42.50 to $45 per ton, in bulk. The powder is quoted at from 3½ to 3¾ cents per pound, in barrels, at works.

BLEACHING POWDER—The bleaching powder market is steady. Prices are unchanged. Bleaching powder is quoted at from $2 to $2.25 per 100 pounds, in drums, at works.

CASEIN—The casein market reports demand as fair. Prices are firm. Domestic standard ground casein is offered at 14 cents per pound; domestic finely ground at 15 cents per pound, all in bags, car lot quantities.

CAUSTIC SODA—The demand for caustic soda continues steady. Prices are firm and unchanged for the week. Solid caustic soda is quoted at from $2.10 to $2.30 per 100 pounds; flake and ground at from $2.50 to $2.70 per 100 pounds, in drums, at works.

CHINA CLAY—The china clay market is steady. Imported clay is quoted at from $14.50 to $25 per ton, ship side. The demand for domestic clay continues good. Domestic filler clay is quoted at from $6.50 to $12 per ton; coating clay at from $11 to $22 per ton, at mines.

CHLORINE—The demand for chlorine continues steady. Prices are firm and unchanged for the current week. Chlorine is quoted at $2.15 per 100 pounds, in single-unit tank cars, f.o.b., works.

ROSIN—The rosin market reports demand as good. Prices are slightly lower for the week. Paper making rosin is quoted at $7; wood rosin at $7.40 per 280 pounds, gross weight, in barrels, at Savannah. Seventy per cent rosin size is quoted at $3.35 per 100 pounds, in tank cars, f.o.b., shipping point.

SALT CAKE—The salt cake market is steady. Prices are firm. Quotations range at from $12 to $13.50 per ton; chrome salt cake at from $11 to $12, f.o.b., shipping point. Imported salt cake is offered at from $14.50 to $15 per ton, Gulf or Atlantc Seaboard, on dock.

SODA ASH—The demand for soda ash continues steady, Quotations on soda ash in car lots, at works, per 100 pounds, are as follows: in bulk, $.90; in bags, $1.05; and in barrels, $1.35.

STARCH—The starch market continues moderately active. Prices are slightly lower for the week. Globe pearl starch is quoted at $3.30 per 100 pounds, in bags, and at $3.55 in barrels. Special paper starch is offered at $3.40 per 100 pounds, in bags, and at $3.65 per 100 pounds in barrels, all prices, car lots, f.o.b., Chicago.

SULPHATE OF ALUMINA—The demand for sulphate of alumina is steady. Prices are firm. The commercial grades are quoted at from $1.25 to $1.60; iron free at from $2 to $2.25 per 100 pounds, in barrels, at works.

SULPHUR—The sulphur market continues steady. Annual contracts are quoted at $18 per long ton, car lots, f.o.b., mines. Spot and nearby car lots are offered at $21 per ton.

TALC—The demand for talc continues good. Domestic talc is quoted at from $15 to $18 per ton, Eastern mines. Imported talc is quoted at from $25 to $40 per ton, on dock.

Market Quotations

Paper

Tissues—Per Ream—

White No. 1	1.10	@	—
White No. 1 M. G.	1.07½	@	—
White No. 1½	.77½	@	—
White No. 2	.75	@	—
Anti-Tarnish M. G.	.77½	@	—
Colored	.90	@	—
Kraft	.77½	@	—
Manila	.75	@	—
Unbleached Toilet	2.90	@	3.30
Bleached Toilet	3.94	@	5.26

Paper Towels—

Unbleached	2.10	@	3.35
Bleached	3.30	@	3.70

Manila—

No. 1 Jute	9.00	@	9.25
No. 2 Jute	7.75	@	8.50
No. 1 Wood	4.00	@	5.25
No. 2 Wood	3.50	@	4.00

Fibre Papers—

No. 1 Fibre	4.25	@	5.50
No. 2 Fibre	4.00	@	4.75

(Delivered New York)

News, per ton—

Roll, contract	42.50	@	—
Sheets	47.50	@	—

Kraft—

No. 1 Northern	5.25	@	5.75
Standard	5.00	@	—
Southern	4.50	@	—
Machine glazed, plain, striped	5.00	@	—

Boards, per ton—

Chip	40.00	@	—
News	37.50	@	—
Sgl. Mla. Ll. Chip	52.50	@	—
Jute Lined Chip	52.50	@	—
White Pat. Coated	65.00	@	67.50
Kraft Liners	55.00	@	—
Binders Boards	75.00	@	80.00

The following are representative of distributors' resale prices:—

Rag Content Bonds and Ledgers—
White, Assorted Items,
Delivered in Zone 1:

	Bonds	Ledgers
100% Rag Ext. No. 1	$41.40@$48.50	$42.55@$50.00
100% Rag	32.80@ 38.50	33.95@ 39.75
85% Rag	32.20@ 37.75	
75% Rag	24.75@ 29.00	25.90@ 30.50
65% Rag	21.65@ 26.25	22.80@ 27.75
50% Rag	18.70@ 22.75	19.90@ 24.25
25% Rag	15.80@ 19.25	16.95@ 20.75

Regular Colors @ $1.50 cwt. extra.
Heavy Colors @ $3.00 cwt. extra

Sulphite Bonds and Ledgers—
White, Assorted Items,
Delivered in Zone 1:

	Bonds	Ledgers
No. 1	$9.35@$11.50	$10.55@$12.75
No. 2	8.50@ 10.25	9.65@ 11.75
No. 4	7.60@ 9.25	8.80@ 10.75

Regular Colors @ $1.50 cwt. extra.
Heavy Colors @ $3.00 cwt. extra.

Free Sheet Book Papers—
White, Cased Paper,
Delivered in Zone 1:

No. 1 Glossy Coated	$12.45	@$14.25
No. 2 Glossy Coated	10.80	@ 12.25
No. 3 Glossy Coated	9.65	@ 11.00
No. 4 Glossy Coated	9.05	@ 10.50
No. 1 Antique (watermarked)	9.05	@ 10.50
No. 2 Offset	8.35	@ 9.50
A Grade E. F.	8.20	@ 9.50
A Grade S. & S. C.	8.45	@ 9.75
B Grade E. F.	7.60	@ 8.75
B Grade S. & S. C.	7.85	@ 9.00
C Grade E. F.	7.30	@ 8.50
C Grade S. & S. C.	7.55	@ 8.75
D Grade E. F.	7.00	@ 8.25
D Grade S. & S. C.	7.25	@ 8.50

Ivory & India at $.50 cwt. extra.

Mechanical Pulp

(On Dock, Atlantic Ports)

No. 1 Imported—

Moist	35.00	@	36.00
Dry	40.00	@	42.00

(Delivered)

No. 1 Domestic and Canadian	36.00	@	37.50

Chemical Pulp

(On Dock, Atlantic, Gulf and West Coast Ports)

Bleached Sulphite (Domestic and Foreign)—

Prime Bleached Sulphite	3.50	@	4.65

Prime Qualities—

Easy-Bleaching Sulphite	3.25	@	3.75
Strong Unbleached Sulphite	2.75	@	3.65

(On Dock, Atlantic Ports)

Kraft Bleached	4.00	@	4.75
Kraft Light & Strong	3.00	@	3.75
Kraft No. 1	2.75	@	3.65
Kraft No. 2	2.50	@	2.75

(F.o.b. Pulp Mill)

Kraft Domestic	2.00	@	3.00

(Delivered)

Soda Bleached	3.25	@	—

Add 60 cents per short ton, dock charges for Albany; $2.50 for Lake Ports East and $3.50 for Lake Ports west of Mackinac Straits.

Domestic Rags

New Rags

(Prices to Mill f. o. b. N. Y.)

Shirt Cuttings—			
New White, No. 1	8.25	@	8.75
Silesias, No. 1	6.63	@	6.88
New Unbleached	8.75	@	9.00
Blue Overall	6.75	@	7.00
Fancy	3.50	@	3.75
Washables	2.50	@	2.75
Mixed Khaki Cuttings	4.25	@	4.50
O. D. Khaki Cuttings	4.75	@	5.00

Old Rags

White, No. 1—			
Repacked	3.75	@	4.25
Miscellaneous	3.00	@	3.25
White, No. 2—			
Repacked	2.60	@	2.85
Miscellaneous	2.00	@	2.25
Thirds and Blues—			
Repacked	2.00	@	2.25
Miscellaneous	1.75	@	2.00
Roofing Rags—			
No. 1	1.45	@	1.50
No. 2	1.15	@	1.25
No. 3 (bagging)	.80	@	.90
No. 4	.80	@	.90
No. 5A	.65	@	.75

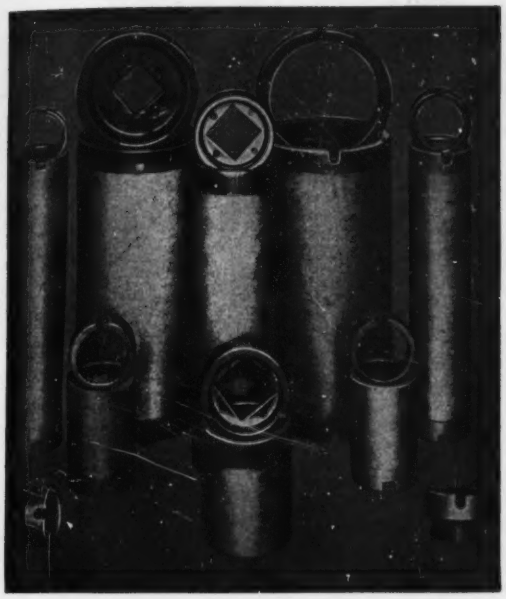
Foreign Rags

New Rags

New Dark Cuttings	2.25	@	2.40
New Mixed Cuttings	2.00	@	2.20
New Light Silesias	5.50	@	5.75
Light Flannelettes	5.50	@	5.75
New White Cuttings	7.00	@	7.50
New Light Oxford	4.00	@	4.50
New Light Prints	3.00	@	3.25

Old Rags

No. 1 White Linens	7.50	@	8.50
No. 2 White Linens	6.50	@	7.50
No. 3 White Linens	4.50	@	5.50



ELIXMAN

CAPS — Straight wound paper cores made in sizes from 2" to 10" inside diameter with any thickness wall required.

Long draw protected slot caps of heavy gauge steel in all standard sizes.

Heavy duty caps with reenforced square hole. This new patented feature of reenforcement gives added strength and durability.

CORES

Samples of caps or cores will be gladly submitted.

ELIXMAN PAPER CORE COMPANY, INC.

CORINTH, N. Y.

"NON-USERS ARE THE LOSERS"

TENAX FELTS

FINISH AND SPEED

FUTURE TRENDS

The future performance of *TENAX FELTS* will be as in the past, "Excellent." We predict this steadfastly and confidently, based on records of long standing.

These records were made in the hard bitter mill of experience.

If you have not experienced the satisfaction to be derived from *TENAX FELTS*, decide to do so at once, and get in touch with us.

"Non-Users Are the Losers"

LOCKPORT FELT COMPANY

NEWFANE, N. Y.—U. S. A.

No. 4 White Linens	2.25	@	3.25
No. 1 White Cotton	4.25	@	4.75
No. 2 White Cotton	3.25	@	3.75
No. 3 White Cotton	2.50	@	3.00
No. 4 White Cotton	1.90	@	2.20
Extra Light Prints	2.00	@	2.40
Ord. Light Prints	1.75	@	2.15
Med. Light Prints	1.55	@	1.95
Dutch Blue Cottons	2.25	@	2.50
French Blue Linens	3.00	@	—
Checks and Blues	2.00	@	—
Linsey Garments	2.10	@	2.20
Dark Cottons	1.75	@	1.85
Old Shopperies	1.60	@	—
New Shopperies	1.60	@	—
French Blues	2.25	@	2.50

Old Rope and Bagging

(Prices to Mill f. o. b. N. Y.)

Gunny No. 1—			
Foreign	2.40	@	2.60
Domestic	2.25	@	2.35
Wool Tares, light	1.75	@	1.85
Wool Tares, heavy	2.10	@	2.15
Bright Bagging	1.60	@	1.70
Manila Rope—			
Foreign	3.50	@	3.75
Domestic	3.75	@	4.00
Jute Threads	2.75	@	3.00
Sisal Strings	2.35	@	2.45
Mixed Strings			Nominal

Old Waste Papers

(F. o. b. New York)

Shavings—			
White Envelope Cuttings	3.10	@	3.25
Ordinary Hard White No. 1	2.60	@	2.70
Hard White No. 2	2.40	@	2.50
Soft White No. 1	2.30	@	2.40
Flat Stock—			
Stitchless	1.10	@	1.15
Overissue Mag	1.10		1.15
Solid Flat Book	.80	@	.90
Crumbled No. 1	.60	@	.70
Ledger Stock	1.55	@	1.60
New B. B. Chips	.35	@	.40
Manila—			
New Env. Cut	2.15	@	2.25
New Cuttings	1.65	@	1.75
Old Kraft Machine—			
Compressed bales	1.15	@	1.25
News—			
No. 1 White News	1.40	@	1.50
Strictly Overissue	.60	@	.70
Strictly Folded	.40	@	.45
No. 1 Mixed Paper	.35	@	.35

Twines

(F. o. b. Mill)

(Soft Fibre)			
Coarse Polished—			
India	.15	@	.16
White Hemp	.16	@	.17
India Compress	.16½	@	.17
Fine Polished—			
Fine India	.20	@	.20
Unpolished—			
Box	.11	@	.13
Paper Makers	.09½	@	.11
Tube Rope	.11½	@	.14¼
Wax Paper	.13½	@	.14¼
Wrapping	.14	@	.17
Soft Fiber Rope	.14¾	@	.15¾
(Hard Fibre)			
Medium Java	.12	@	.13
Mex. Sisal	.12	@	.12½
Manila	.22	@	.29½

Domestic	4.00	@	—
Transmission Rope	2.10	@	2.40
Soft Jute Ropes	2.00	@	2.25
Jute Carpet Threads	1.75	@	2.00
Gunny No. 1—			
Foreign	2.50	@	2.60
Domestic	2.00	@	2.10
Bleachery Burlap	4.00	@	4.25
Scrap Burlap—			
Foreign	2.15	@	2.25
Domestic	1.75	@	2.00
Scrap Sisal	1.90	@	2.00
Scrap Sisal for Shredding	2.50	@	2.65
Wool Tares, heavy	—	@	2.15
New Burlap Cuttings	2.45	@	3.00
Aust. wool pouches	3.60	@	3.75
Heavy bailing bagging	2.50	@	2.70
Paper Mill Bagging	1.65	@	1.70
Bagging No. 2	1.00	@	1.10

Domestic Rags (New)

(F. o. b. Boston)

Shirt Cuttings—			
New Light Prints	.03½	@	.03¾
New White No. 1	.08	@	.08¼
New White No. 2	.06	@	.06¼
New Light Flannelettes	—	@	.06½
Silesias No.	—	@	.06½
New Black Silesias	.04¼	@	.04½
Silesias No. 1			
Soft Unbleached	.08¼	@	.08¾
Blue Cheviot	.07½	@	.07½
Fancy	.03¾	@	.04
Washable	.03	@	.03¼
Cottons—According to grades—			
Blue Overalls	.07	@	.07¼
New Black, soft	.04¼	@	.04½
Khaki Cuttings	.04½	@	.04¾
O. D. Khaki	.04¾	@	.05
Corduroy	.03¼	@	.03¾
New Canvas	.07¾	@	.08¼
B.V.D. Cuttings	.08¾	@	.09

Domestic Rags (Old)

(F. o. b. Boston)

Canvas	.04½	@	—
White No. 1—			
Repacked	—	@	2.75
Miscellaneous	2.50	@	2.75
White No. 2—			
Repacked	1.90	@	2.00
Miscellaneous	2.00	@	2.25
Twos and Blues	1.75	@	2.00
Third and Blues—			
Repacked	1.37½	@	1.75
Miscellaneous	1.25	@	1.62½
Black Stockings	3.90	@	4.00
Roofing Stock—			
No. 1	1.27	@	1.28
No. 2	1.22	@	1.23
No. 3	1.19	@	1.20

Foreign Rags

(F. o. b. Boston)

Dark Cottons	1.50	@	1.60
Dutch Blues	2.85	@	3.00
New Checks and Blues	2.85	@	3.00
Old Fustians	2.50	@	2.60
Old Linsey Garments	1.90	@	2.00
New Silesias	6.50	@	7.00

PHILADELPHIA

Domestic Rags (New)

(Price to Mill, f. o. b. Phila.)

Shirt Cuttings—			
New White, No. 1	.07½	@	.08
New White, No. 2	.04½	@	.05
Light Silesias	.05½	@	—
Silesias, No. 1	—	@	.05½
Black Silesias, soft	.03	@	.03½
New Unbleached	.07½	@	.08
Washable, No. 1	.02	@	.02¼
Blue Overall	.04½	@	.05
Cottons According to grades—			
Washable, No. 2	—	@	.01¼
New Blue	.01½	@	.01¾
Fancy Percales	—	@	.03½
New Black Soft	.03	@	.03½
New Light Seconds	—	@	.05½
New Dark Seconds	1.25	@	1.50
Khaki Cuttings—			
No. 1 O. D.	.03½	@	.04
No. 2 Mixed	—	@	.02¾
Corduroy	.02¾	@	.03
New Canvas	.06	@	.06½
New Black Mixed	.02	@	.02¾

Domestic Rags (Old)

White No. 1—			
Repacked	3.00	@	3.25
Miscellaneous	2.50	@	2.75
Thirds and Blues—			
Miscellaneous	2.00	@	2.25
Repacked	2.25	@	2.50
Black Stockings (Export)	4.00	@	4.50
Roofing Stock—			
Foreign No. 1	1.50	@	1.75
Domestic No. 1	1.50	@	1.70
Domestic No. 2	1.30	@	1.40
Roofing Bagging	—	@	1.25

Bagging

(F. o. b. Phila.)

Gunny, No. 1—			
Foreign	1.80	@	2.00
Domestic	2.00	@	2.25
Manila Rope	3.75	@	4.00
Sisal Rope	2.00	@	2.25
Mixed Rope	1.00	@	1.10
Scrap—			
No. 1	1.50	@	1.75
No. 2	1.00	@	1.25
Wool Tares, heavy	3.25	@	3.50
Mixed Strings	1.00	@	1.10
No. 1 New Light Burlap	3.00	@	3.50
New Burlap Cuttings	2.00	@	2.25

Old Papers

(F. o. b. Phila.)

Shavings—			
No. 1 Hard White	2.55	@	2.75
No. 2 Hard White	2.40	@	2.55
No. 1 Soft White	2.25	@	2.30
No. 2 Soft White	1.50	@	1.75
No. 1 Mixed	.80	@	.90
Solid Ledger Stock	1.75	@	1.85
Ledger Stock, white	1.50	@	1.60
Ledger Stock, colored	1.35	@	1.45
No. 1 Books, heavy	1.05	@	1.10
Manila Cuttings	1.75	@	1.85
Print Manila	.50	@	.55
Container Manila	.45	@	.50
Kraft Paper	1.15	@	1.20
No. 1 Mixed Paper	.35	@	.45
Straw Board Chip	.40	@	.45
Binders Board Chip	.40	@	.45
Corrugated Board	.50	@	.55
Overissue News	.60	@	.65
Old Newspapers	.40	@	.45

BOSTON

Old Papers

(F. o. b. Boston)

Shavings—			
No. 1 Hard White	2.25	@	2.40
No. 1 Soft White	1.85	@	2.15
No. 2 Mixed	.75	@	.80
Solid Ledger Books	1.50	@	1.75
Overissue Ledger Stock	1.30	@	1.50
Mixed Ldgers	.85	@	.90
No. 1 Books, heavy	1.00	@	1.10
No. 1 Books, light	.65	@	.75
Crumpled Stitchless Book Stock	.50	@	.60
Manila Env. Cuttings	1.60	@	1.70
Manila Env. Cuttings, extra quality	2.20	@	2.30
No. 1 Old Manila	.95	@	1.00
White Blank News	1.30	@	1.40
No. 1 Kraft	1.30	@	1.40
Mixed Papers	.27½	@	.30
Print Manila	.60	@	.65
Container Manilas	.27½	@	—
Old Newspapers	.32½	@	.35
Overissue News	.45	@	.50
Box Board Chips	.35	@	.40
Corrugated Boxes	.30	@	.40
Kraft corrugated boxes	—	@	1.00
Screening Wrappers	.55	@	.60

Bagging

(F. o. b. Boston)

Manila Rope—			
Foreign	—	@	3.75

CHICAGO

Old Papers

(F. o. b. Chicago)

Shavings—			
No. 1 White Envelope Cuttings	3.30	@	3.40
No. 1 Hard White	2.60	@	2.70
No. 1 Soft White	2.10	@	2.15
Ledger & Writings	1.40	@	1.50
Solid Books	1.25	@	1.30
Blanks	1.05	@	1.20
Kraits	1.00	@	1.25
New Kraft Cuts	1.80	@	2.00
Manila Env. Cuts	2.20	@	2.33
Ex. No. 1 Manila	2.20	@	2.33
Print Manila	1.70	@	1.80
Overissue News	.40	@	.50
Old Newspapers—			
No. 1 Folded News	.35	@	.45
No. 1 Mixed Paper	.35	@	.45
Roofing Stocks—			
No. 1	2.00	@	2.33
No. 2	1.85	@	2.00

TORONTO

Paper

Bonds and Ledgers

Delivered

No. 1 White	.35½	@	.36½
No. 1 Tints	.36½	@	.37½
No. 2 White	.26½	@	—
No. 2 Tints	.27½	@	—
No. 4 White	—	@	.1550
No. 4 Tints	.16	@	.1650
No. 5 Bond—White	11.35	@	—
No. 5 Bond—Tints	12.35	@	—
No. 5 Bond—Golden Rod	13.35	@	—
No. 5 Ledger—White	.1185	@	—
No. 5 Ledger—Tints	.1285	@	—
No. 6 Bond—White	10.75	@	—
No. 6 Bond—Tints	11.25	@	—
No. 6 Bond—Golden Rod	12.75	@	—
No. 7 Bond—White	9.10	@	—
No. 7 Bond—Tints	9.60	@	—
No. 7 Bond—Golden Rod	11.10	@	—
Book—			
No. 1 M. F.	7.10	@	7.35
No. 2 M. F.	6.85	@	7.20
No. 3 M. F.	5.60	@	6.20
No. 1 S. C.	7.60	@	7.85
No. 2 S. C.	7.10	@	7.35
No. 3 S. C.	6.10	@	6.35
No. 1 Coated and Litho	12.50	@	—
No. 2 Coated and Litho	11.00	@	—
No. 3 Coated and Litho	9.50	@	10.00
Coated tinted	13.00	@	13.50
Wrapping—delivered—			
Rag Brown	4.85	@	5.55
White Wrap	4.00	@	—
"B" Manila	4.90	@	6.25
No. 1 Manila	5.50	@	7.00
Fiber	5.50	@	—
Kraft, No. 2	5.50	@	—

(F. o. b. Cars, Toronto)

News, per ton—			
Rolls (contract)	38.50	@	—
Sheets	45.50	@	—

Pulp

Ground wood	32.00	@	—
Unbleached Sulphite	59.00	@	—
Book (Class 1)	71 00	@	—
Writing (Class 2)	72.00	@	—
Select (Class 3)	73.00	@	—

Old Waste Paper

(In carload lots, f. o. b. Toronto)

Shavings—			
White Env. Cut	2.50	@	—
Soft White	2.15	@	—
White Blk. News	1.25	@	1.40
Book and Ledger—			
Flat Magazine and Book Stock (old)	1.00	@	—
Light and Crumpled Book Stock	.85	@	—
Ledgers and Writings	1.20	@	—
Manilas—			
New Manila Cut	1.50	@	—
Printed Manilas	.65	@	—
Kraft	1.00	@	1.70
News and Scrap—			
Strictly Overissue	.65	@	—
Strictly Folded	.60	@	—
No. 1 Mixed Paper	.50	@	—

Domestic Rags

(Price to mills, f. o. b. Toronto)

No. 1 White Shirt Cuttings	.09	@	.09¼
Fancy Shirt Cuttings	.03½	@	.03¾